The MacroVU® Course

Visual Thinking and Visual Communication

by
Robert E. Horn

Version 3
January 1997
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Introduction

I prepared this Course Manual for the course I developed called Visual Thinking and Visual Communication. The course and lectures were presented at a couple dozen two-day workshops over several years, beginning in 1997, for the Boeing Company and at the Principal Financial company. Well over a thousand people attended the series of workshops.

I have managed recently to translate the Course Manual from their original computer files for this PDFs.

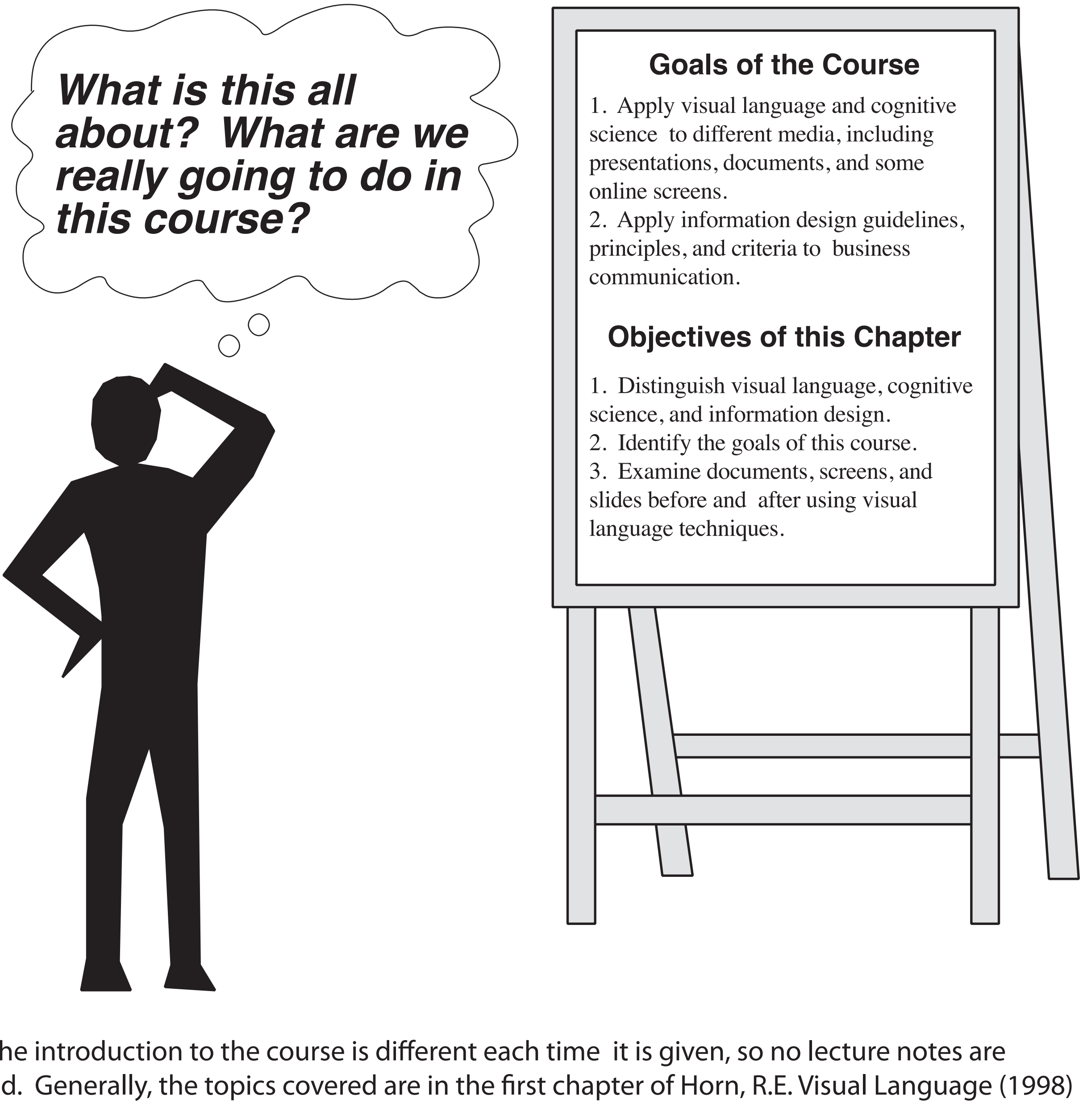
Intended audience

The intended audience for this workshop and the accompanying lectures was people who needed to use more visualization in their jobs, persons who wrote training materials and systems documentation, proposals and analysis, public communication and managerial communication. It had been recognized by Boeing and Principal that they had many communicators who were pretty good writers but whose effectiveness could be improved by learning the basics of visualization.

Robert E. Horn
San Francisco, California
September 2016

Chapter 1

Introduction to Visual Thinking and Visual Communication


What is this all about? What are we really going to do in this course?

Goals of the Course

1. Apply visual language and cognitive science to different media, including presentations, documents, and some online screens.
2. Apply information design guidelines, principles, and criteria to business communication.

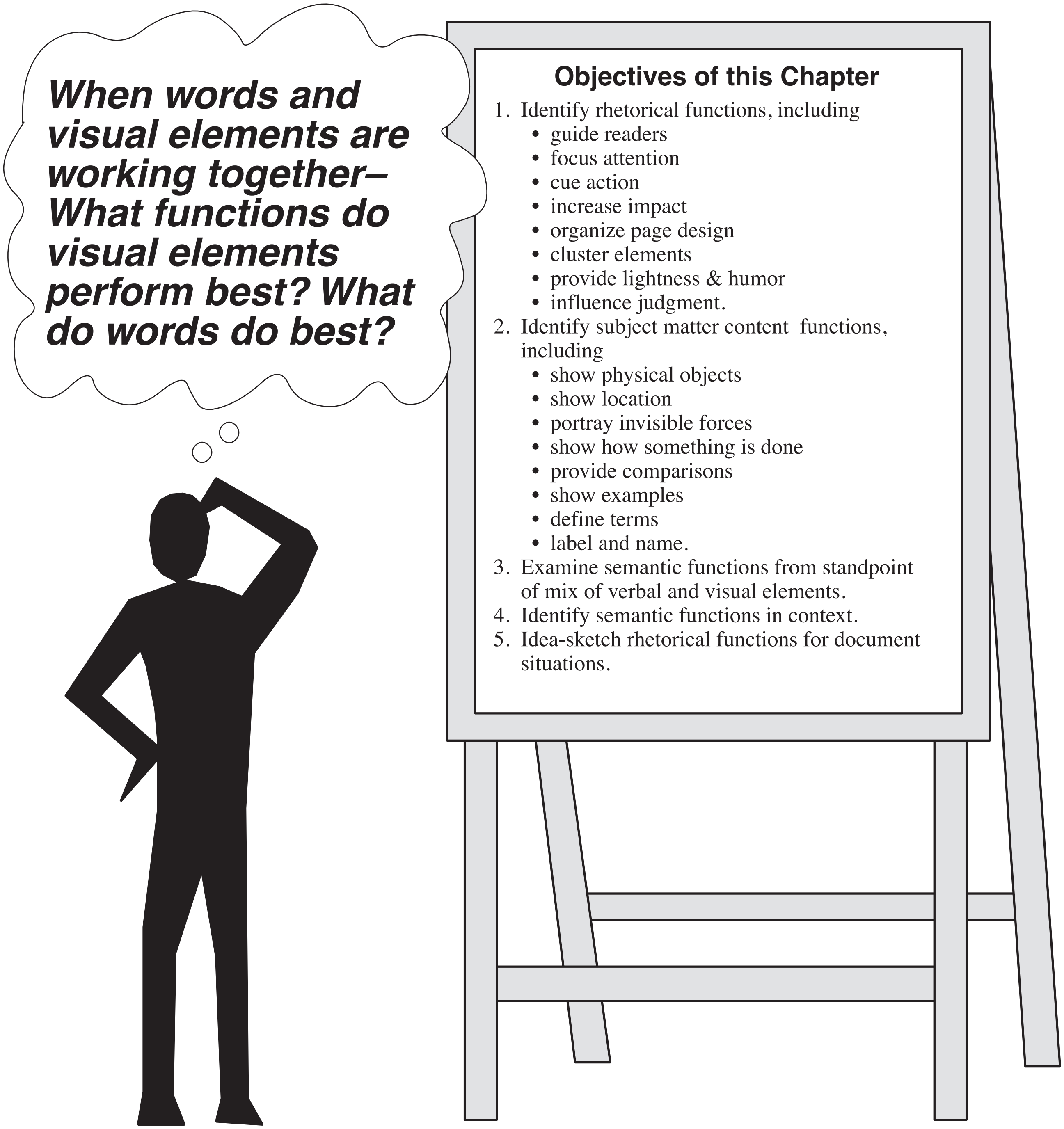
Objectives of this Chapter

1. Distinguish visual language, cognitive science, and information design.
2. Identify the goals of this course.
3. Examine documents, screens, and slides before and after using visual language techniques.

Note. The introduction to the course is different each time it is given, so no lecture notes are provided. Generally, the topics covered are in the first chapter of Horn, R.E. Visual Language (1998)

Chapter 2

Functional Semantics of Visual Language


When words and visual elements are working together– What functions do visual elements perform best? What do words do best?

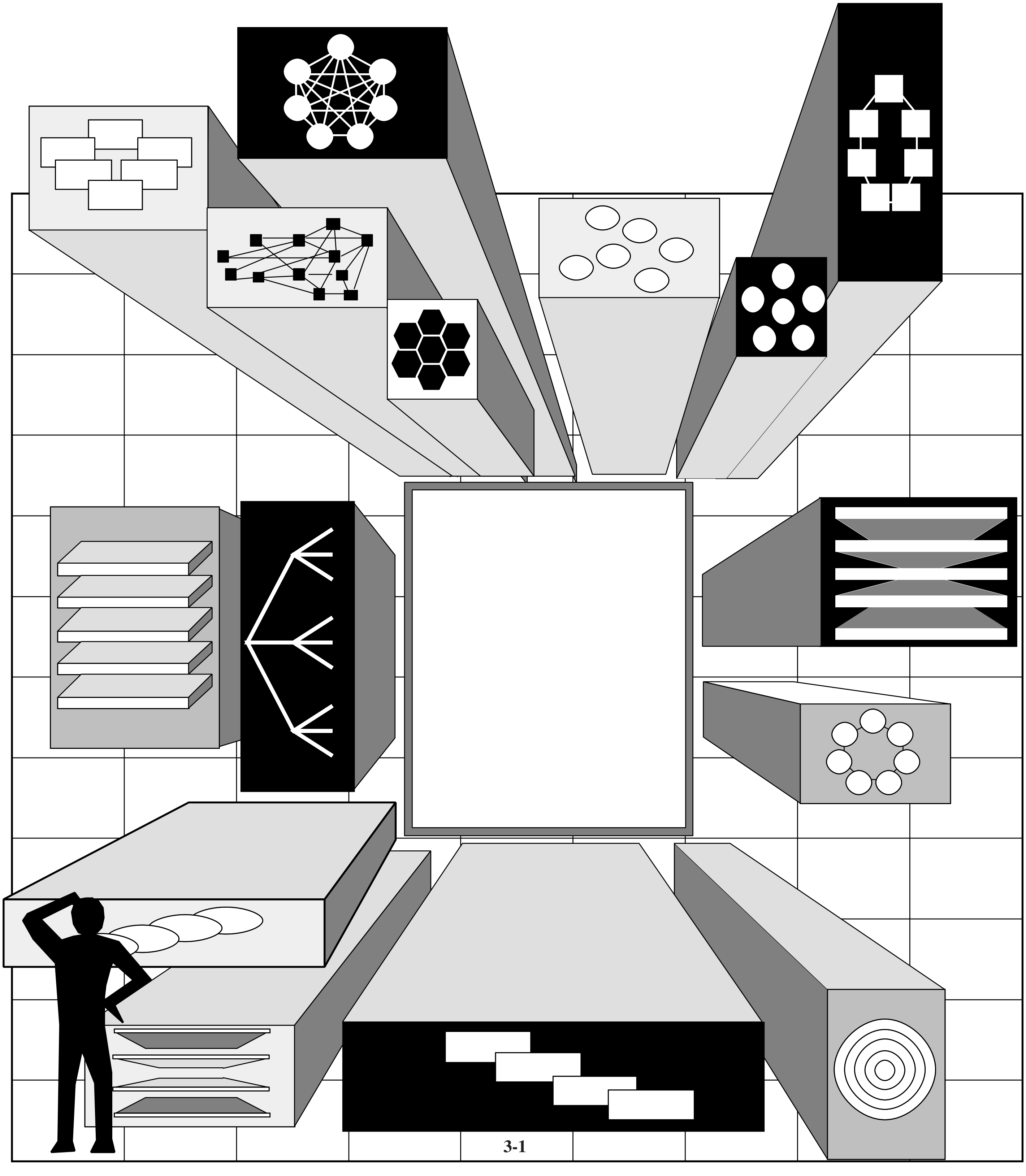
Objectives of this Chapter

1. Identify rhetorical functions, including
   - guide readers
   - focus attention
   - cue action
   - increase impact
   - organize page design
   - cluster elements
   - provide lightness & humor
   - influence judgment.
2. Identify subject matter content functions, including
   - show physical objects
   - show location
   - portray invisible forces
   - show how something is done
   - provide comparisons
   - show examples
   - define terms
   - label and name.
3. Examine semantic functions from standpoint of mix of verbal and visual elements.
4. Identify semantic functions in context.
5. Idea-sketch rhetorical functions for document situations.

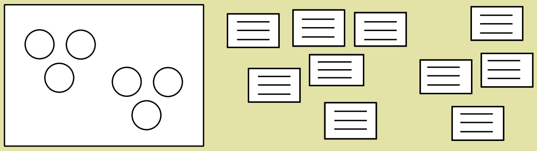
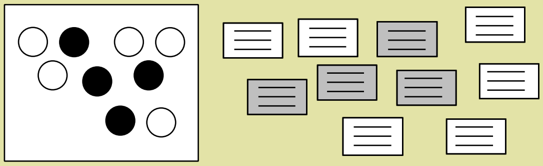
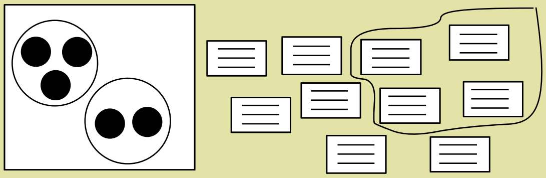
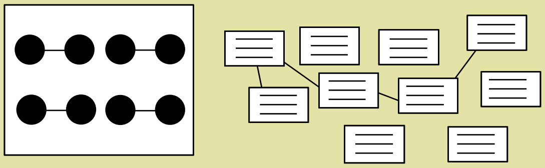
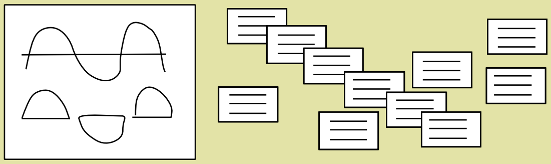
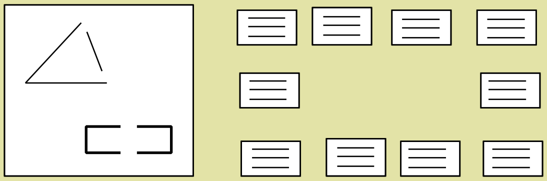
Note. The introduction to the course is different each time it is given, so no lecture notes are provided. Generally, the topics covered are in chapters 5 & 6 of Horn, R.E. Visual Language (1998)

Chapter 3

Cluster Diagrams



Clustering and Gestalt Theory

Usual Name of Gestalt Principle	Gestalt Principles	Use of Gestalt Principles
Principle of Proximity	In a total stimulus situation, human beings have a tendency to group together those elements or units that are closest to each other, all other things being equal.	
Principle of Similarity	Human beings have a tendency to group together in a single structure those parts or units that appear to be similar in visual properties such as size, shape, color, darkness, etc., all other things being equal.	
Principle of Common Region (or Closed Forms)	Human beings have a tendency to see elements or units enclosed by a line on a surface as a single unit, all other things being equal.	
Principle of Connectedness	Human beings have a tendency to perceive any uniform, connected region as a single unit. The region may be points, lines, or a more extended area.	
Principle of Good Continuation	Human beings have a "tendency to group together in a single structure those parts or units that appear to be aligned with or smooth directional continuations of one another, all other things being equal." In this example we see a line, not three segments.	
Pragnanz (or "Closure") Principle	When stimuli are ambiguous, human beings have a tendency to make perception as "good" (meaning simple, regular, and symmetric) as the "prevailing conditions" allow. Human beings have a tendency to "group into unified structure those components that together constitute a closed entity rather than an open one," all other things being equal.	

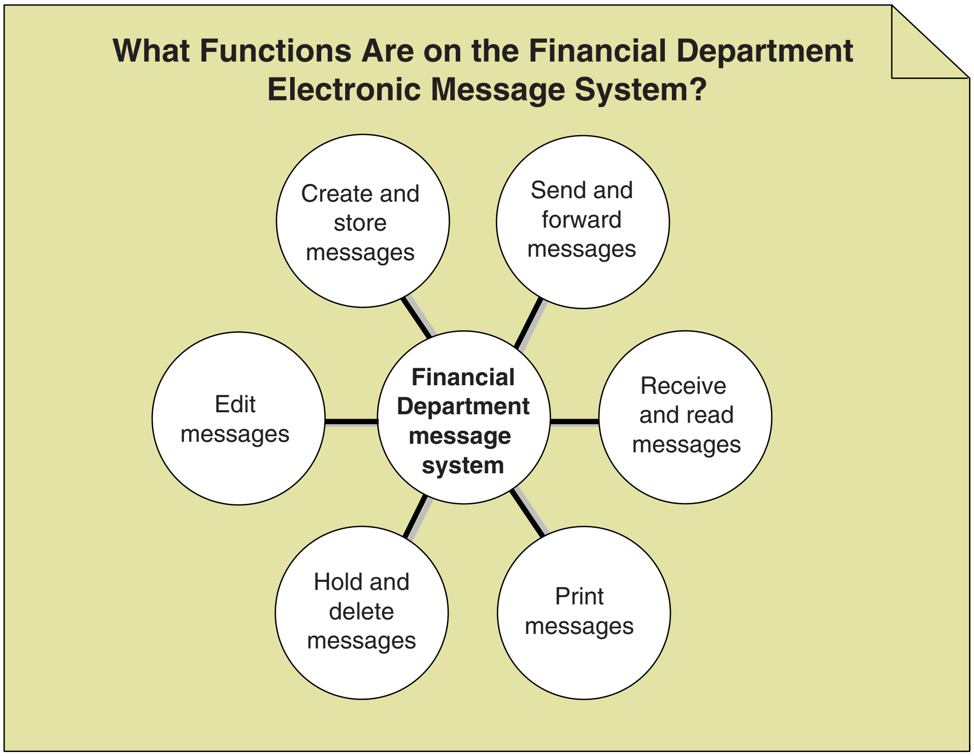
Quotes are from Rock (1993)

Cluster Diagrams

Definition

clus • ter di • a • grams
Any one of a group of specific shapes and assemblies of shapes used to assemble and combine images, words, or other shapes on a page or display screen.

Example

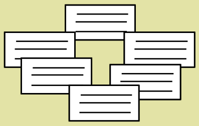


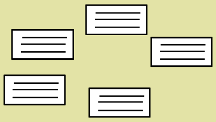
What Functions Are on the Financial Department Electronic Message System?

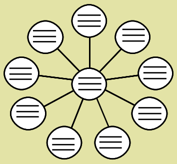
Create and store messages
Send and forward messages
Edit messages
Financial Department message system
Receive and read messages
Hold and delete messages
Print messages

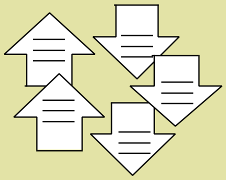
Other examples

Here are some typical examples of cluster diagrams:









Definitions

se • man • tics
The study of meaning.

syn • tax
1. (in linguistics) The way in which basic components, words, are put together in phrases, clauses, and sentences. [fr. GK. *syntaxis* arrangement]
2. (in visual language) The study of the combinations and relationships of verbal and visual elements.

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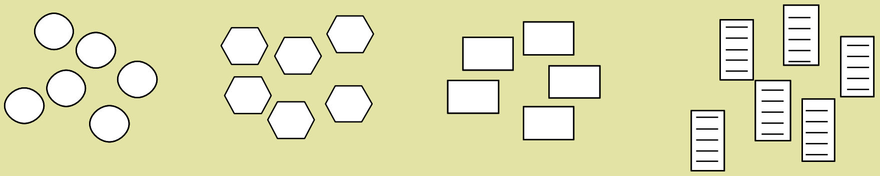
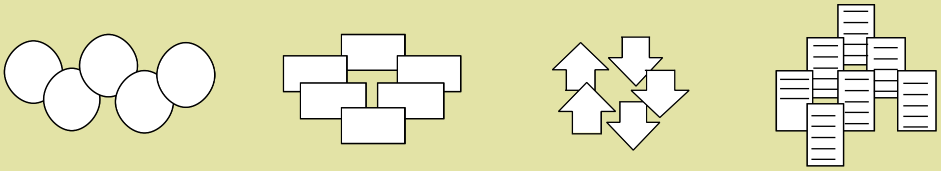
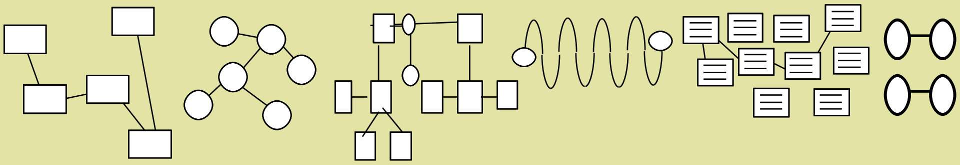
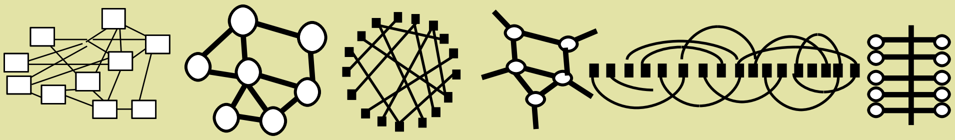
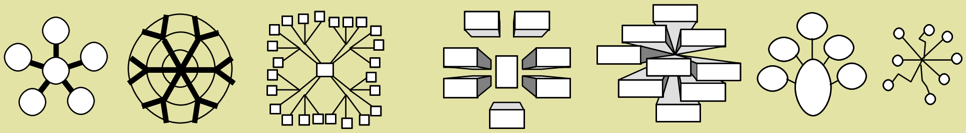
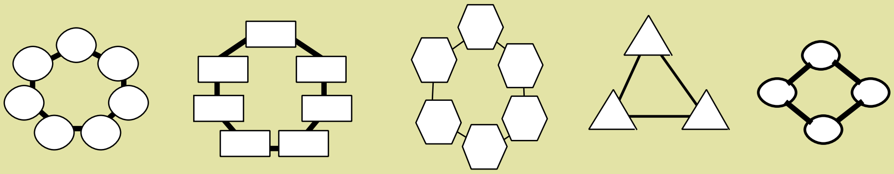
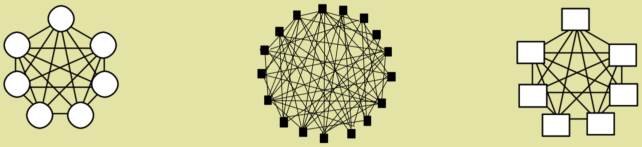
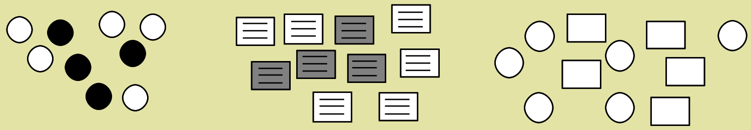
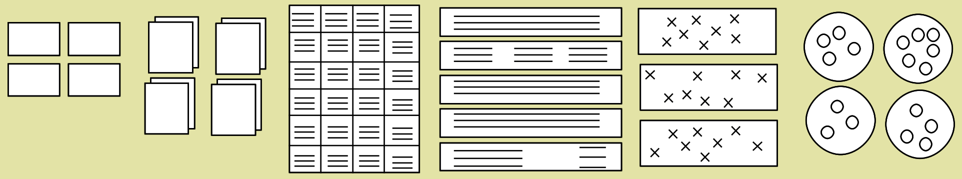
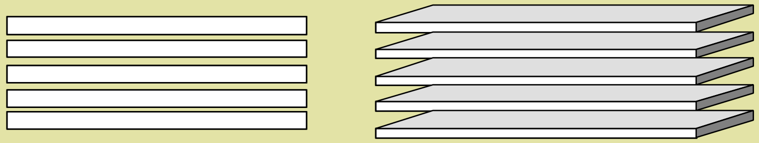
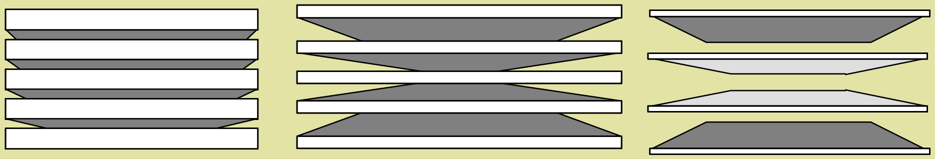
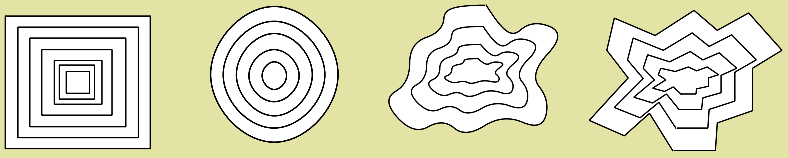
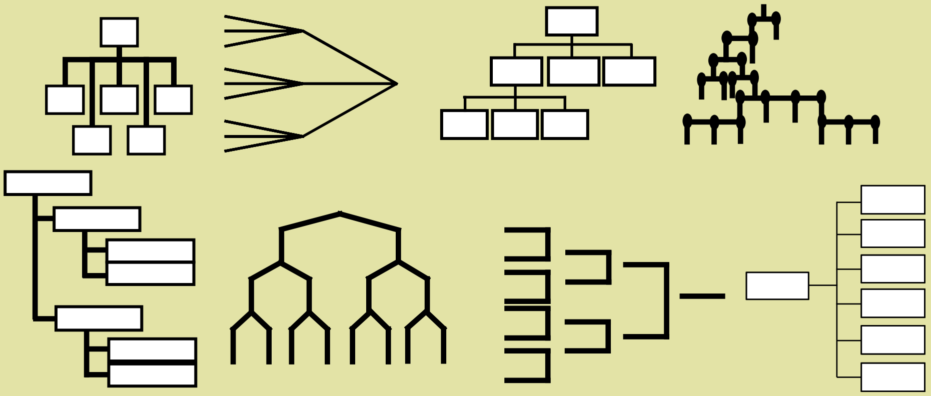
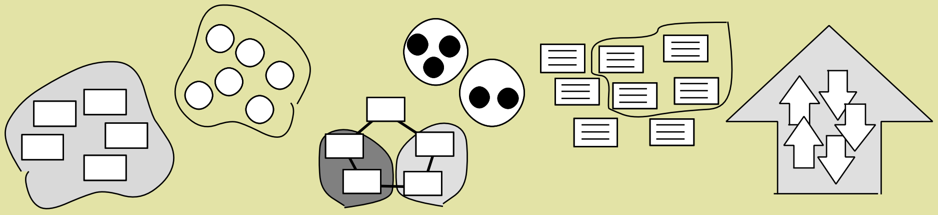
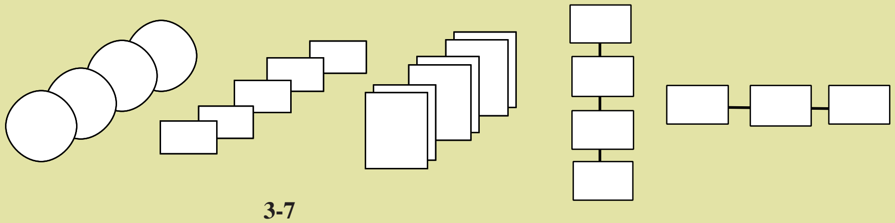
Syntax and Semantics—Cluster Diagrams

Semantic Concept	Visual Syntax
• Close to • In same vicinity as • Adjacent	
• Overlapping in proximity to	
• Connected by links	
• Connected one to many	
• Connected to central element • Generated by	
• Connected around the rim • Cyclical • Repetitive	
• Every thing connected to every other thing	
• Is similar to • Is different from	

Syntax and Semantics—Cluster Diagrams

Semantic Concept	Visual Syntax
• Columns and rows • Equidistant patterns or parts • Repeated patterns	
• Is layered • In levels • Is hierarchical	
• Bursting out • Is important/ significant	
• Contained within	
• Division/merging • Separating/coming together • Hierarchical	
• Bounded by • In same group as • Similar in one respect	
• In a sequence of	

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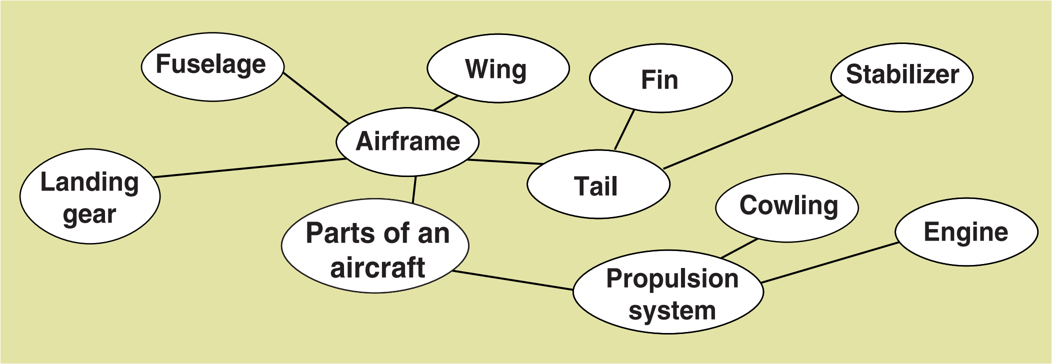
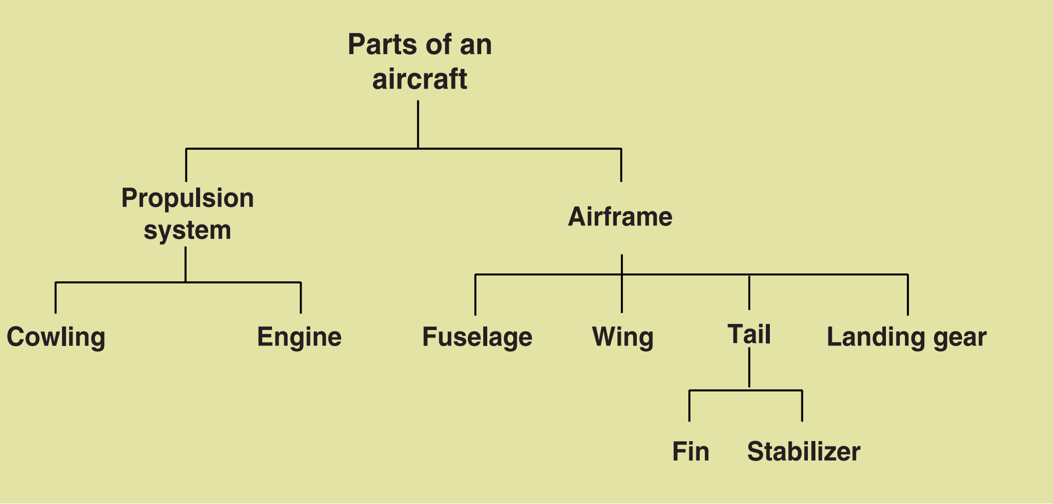
Multiple Ways of Showing Visual Syntax of Hierarchy

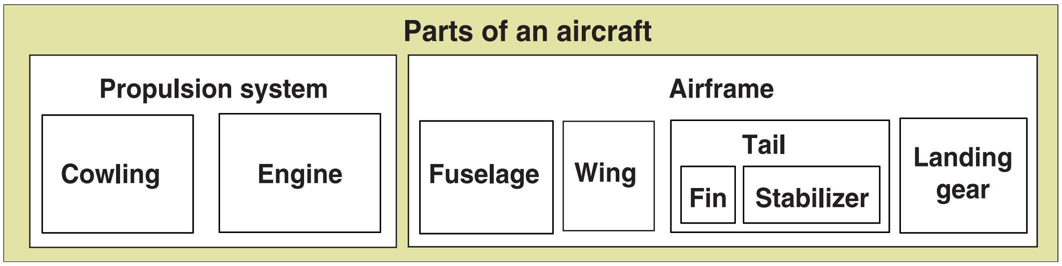
Network Diagram



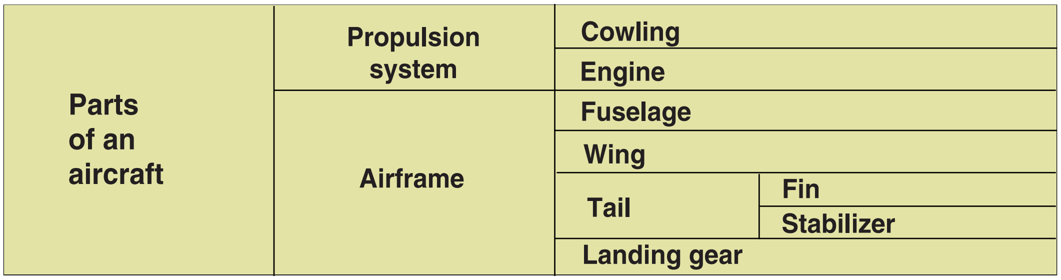
Tree Diagram



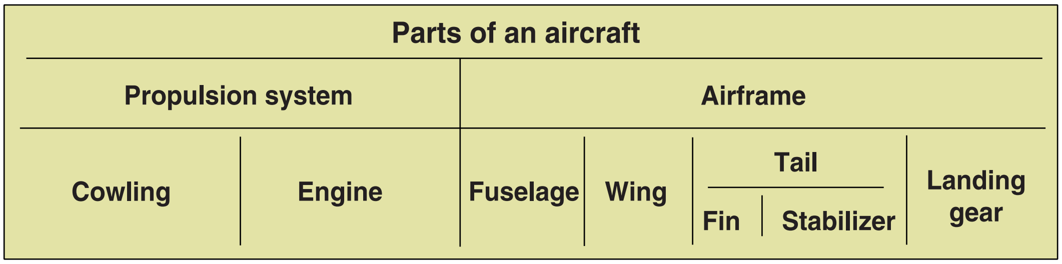
Chinese Box Diagram



Horizontal Table



Vertical Table



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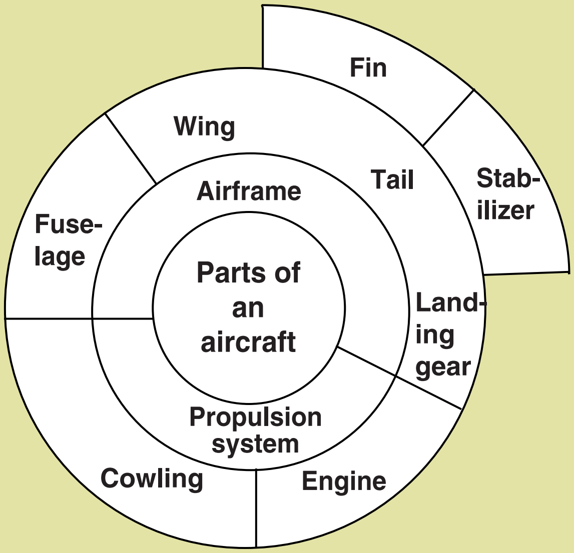
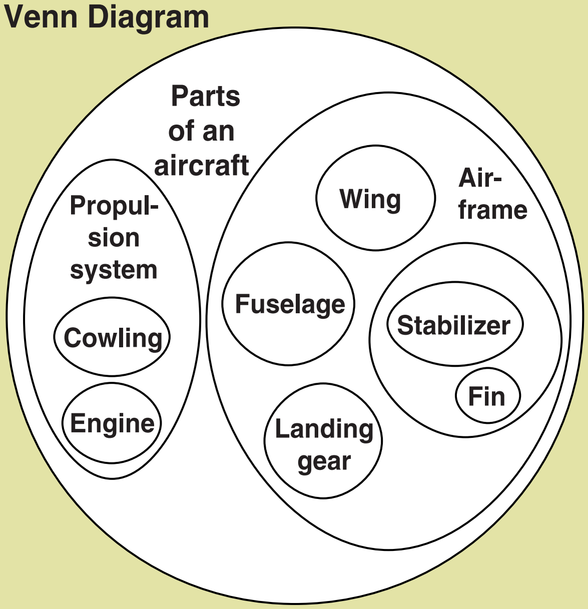
Mandala Diagram



Venn Diagram



Visual Outlines

- Parts of an aircraft
  - Propulsion system
    - Cowling
    - Engine
  - Airframe
    - Fuselage
    - Wing
    - Tail
      - Fin
      - Stabilizer
  - Landing gear

- Parts of an aircraft
  - Propulsion system
    - Cowling
    - Engine
  - Airframe
    - Fuselage
    - Wing
    - Tail
      - Fin
      - Stabilizer
    - Landing gear

Parts of an aircraft

- ❏ Propulsion system
  - • Cowling
  - • Engine
- ❏ Airframe
  - • Fuselage
  - • Wing
  - • Tail
    - —Fin
    - —Stabilizer
  - • Landing gear

Shaded Table

Parts of an aircraft	Propulsion system	Cowling	
		Engine	
	Airframe	Fuselage	
		Wing	
		Tail	Fin
			Stabilizer
		Landing gear	

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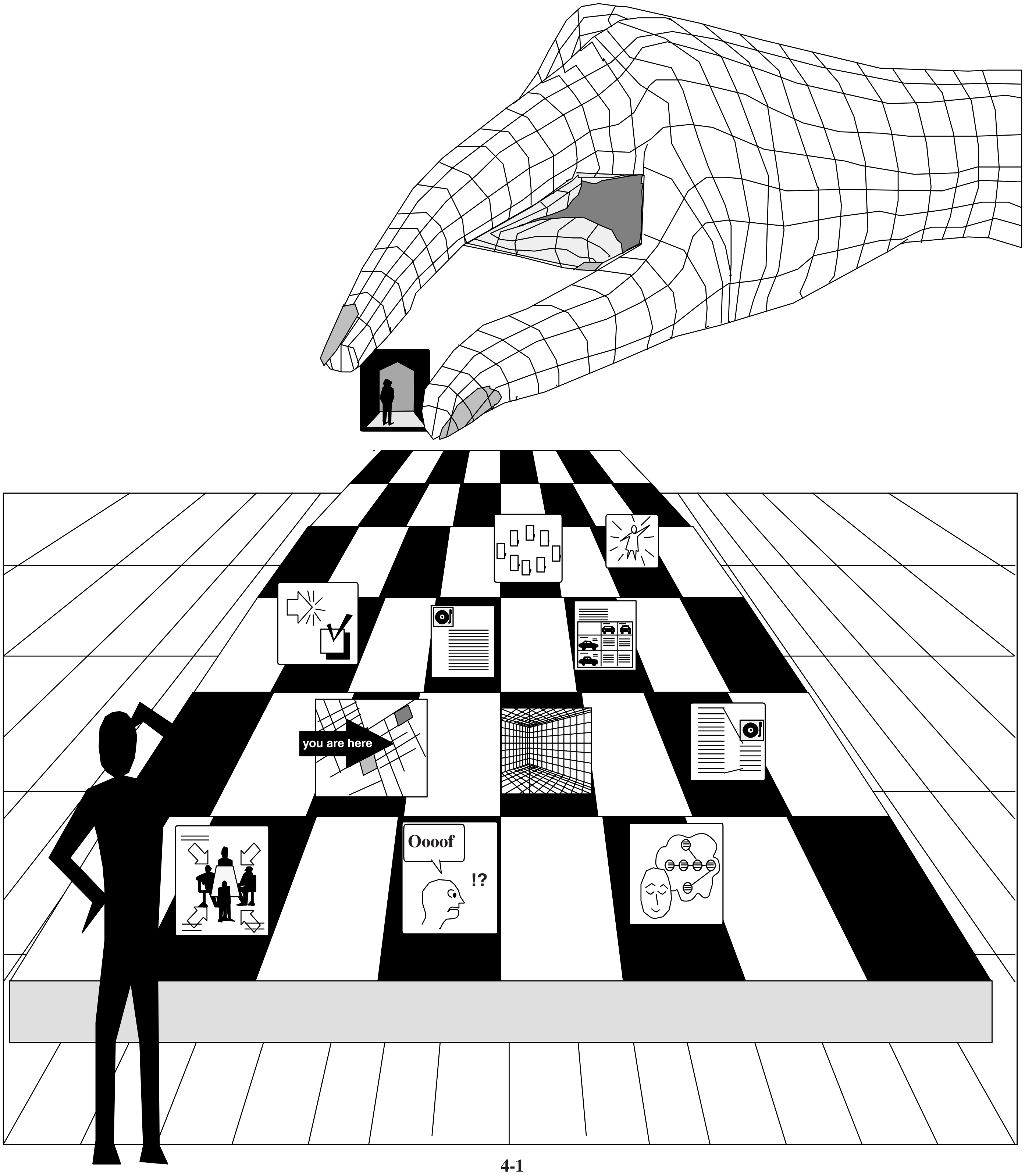
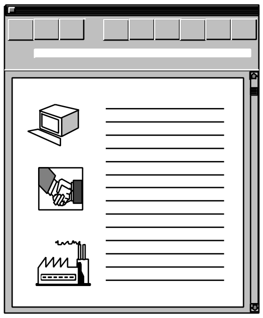
Chapter 4

Icons and VLicons



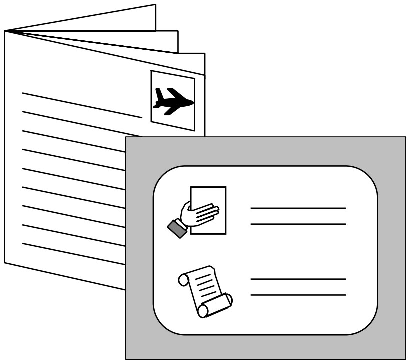
Design Context

Computer screens and interfaces

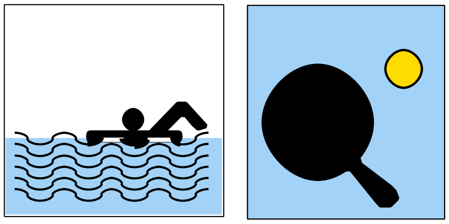


These are the two contexts with which we will be primarily concerned in this class.

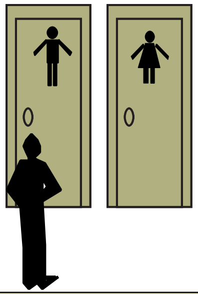
Documents and slides



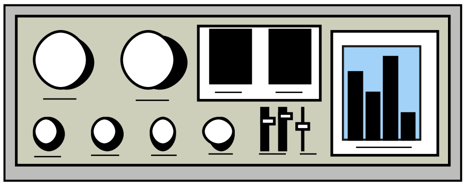
International events
(e.g. Olympics)



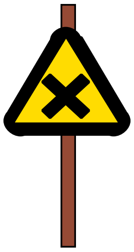
Public facilities
(e.g. traffic and airport signs, museums and zoos, hospitals)



Labels on equipment
(e.g. automobile or medical equipment control panel)



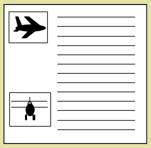
International traffic signs



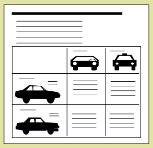
Functional Semantics

Major functions

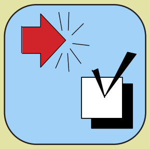
Identify/help discriminate among topics



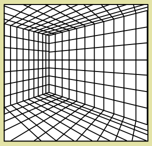
Label blocks of text for function or content



Focus attention

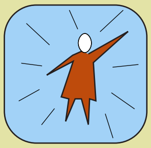


Reinforce or remind the reader of ideas (especially spatial ones)

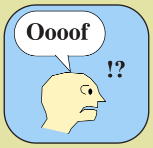


Emotional-cognitive functions

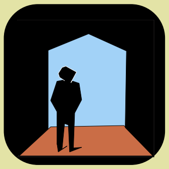
Add or maintain visual interest



Make a comment

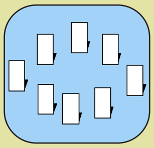


Set a mood

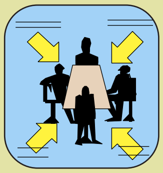


Organizing and showing component functions

Organize space

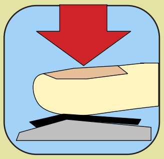


Used as parts of diagrams (for a variety of functions)

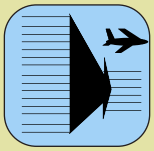


Learning and administrative functions

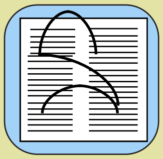
Augment readability (for those with limited linguistic skills)



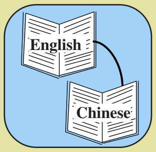
Reduce amount of text



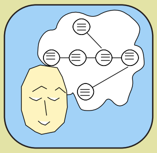
Increase scanning and retrieval speed



Reduce and simplify translation

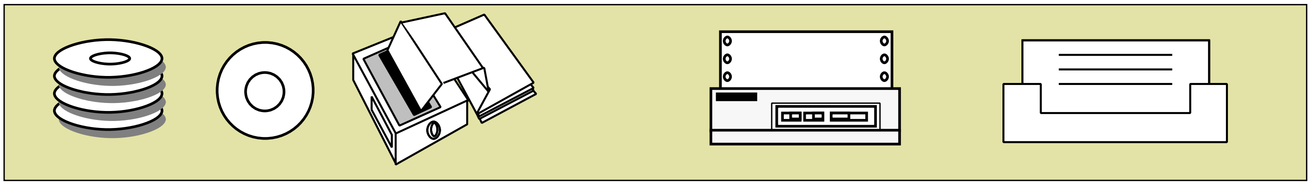


Reinforce remembering

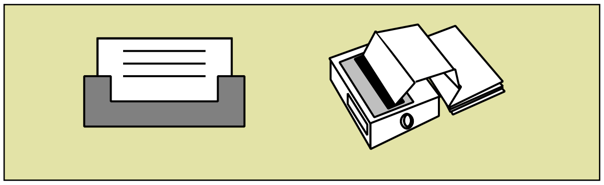


Design Considerations—1

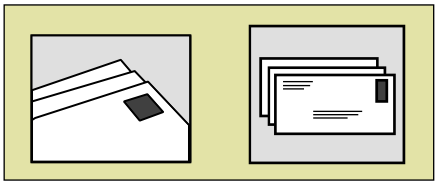
Realistic, detailed or stylized, flat

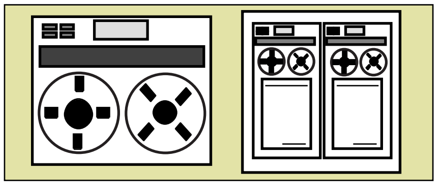


2D or 3D

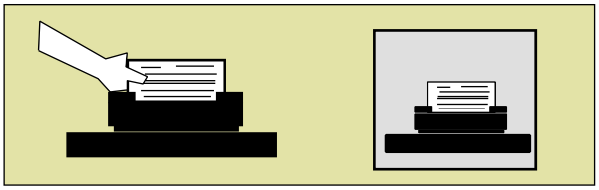


Part or whole

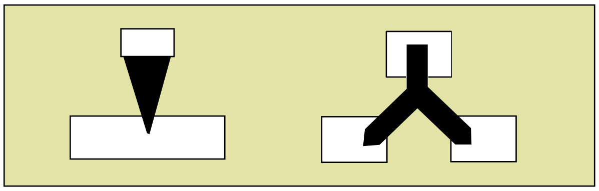




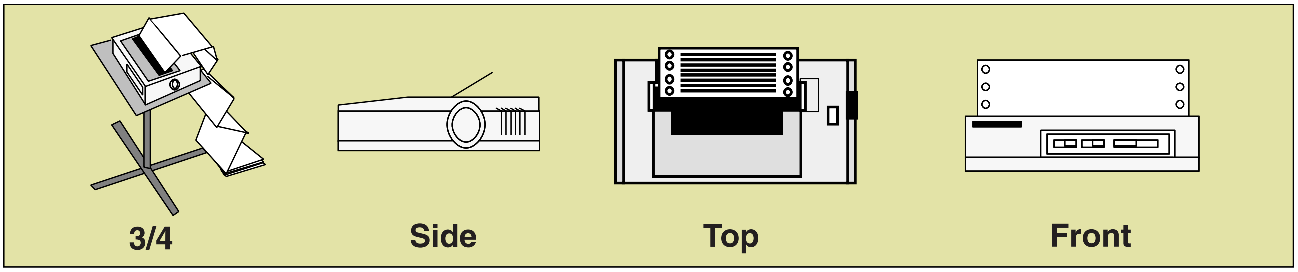
Foreground only or figure and frame



Direction of reading

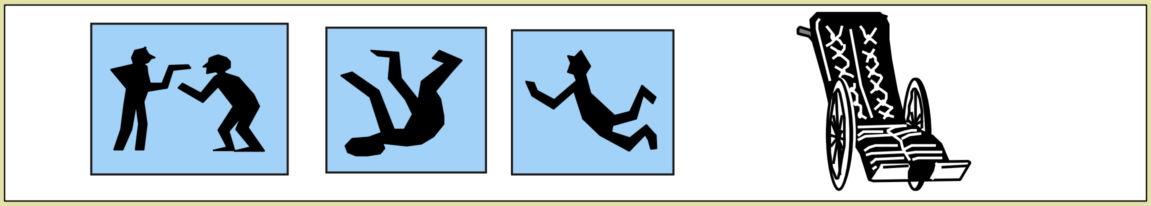


Viewpoint

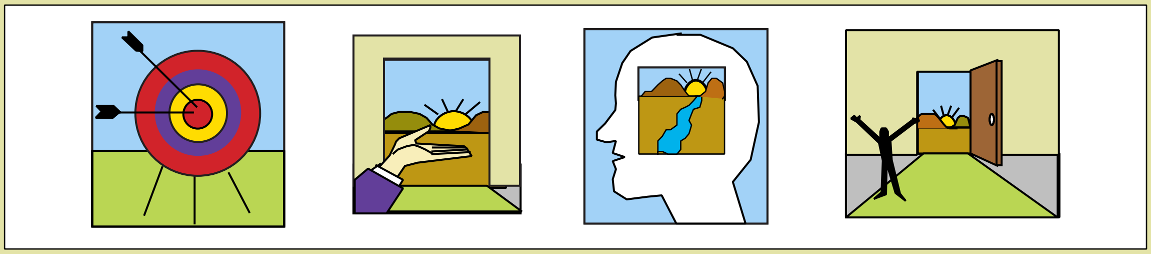


Design Considerations—2

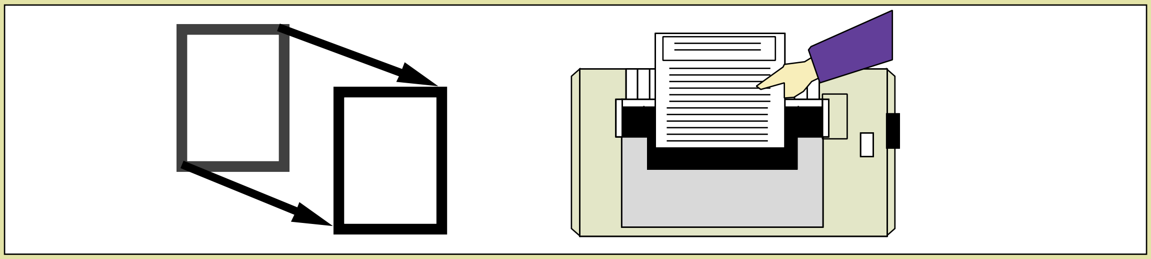
Style (e.g. comic, old-fashioned, etc.)



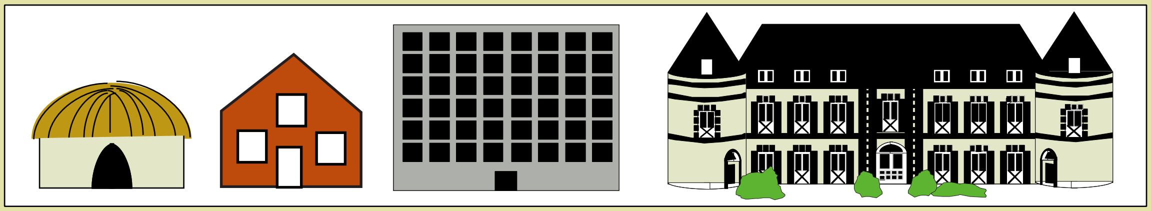
Metaphor



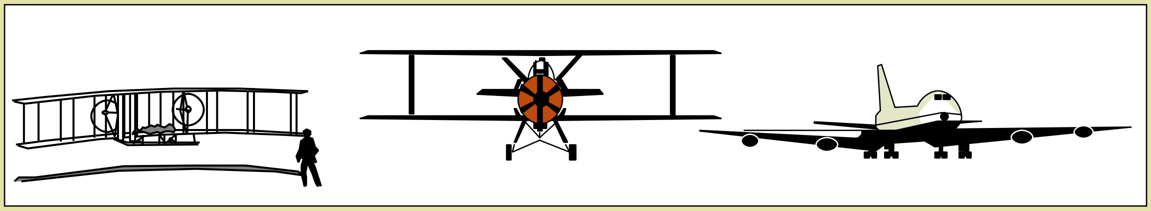
Abstract/symbolic or realistic



National/regional/cultural



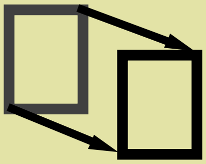
Historical changes



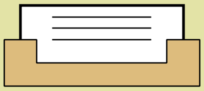
Design Considerations—3

Types of vocabulary

Verbs (commands, actions)



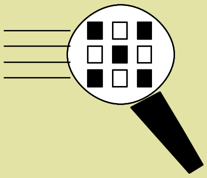
Move window/ document



Print

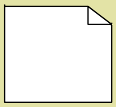
7 → 0111

Change to binary



Magnify (zoom in)

Nouns (designators)



The sheet of paper/ document

The printer

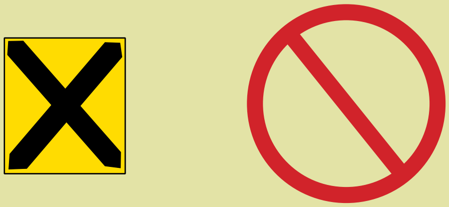
7

A decimal number

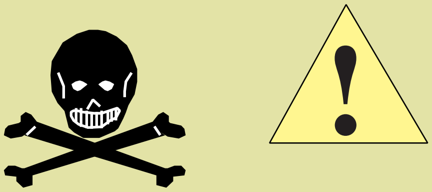
0111

A binary number

Negations



Warnings



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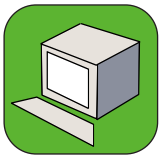
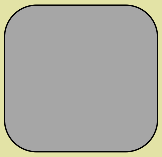
Visual Components of VLicons

The VLicon



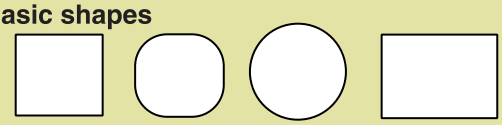
Main

Background & shape



Possibilities

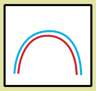
Basic shapes



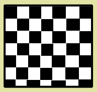
none

Background

Grayscale

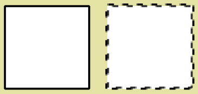


Color

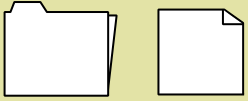


Texture

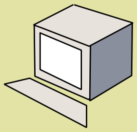
Weight of borders



Meaningful shapes

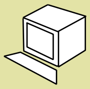


Foreground and subject

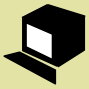


Possibilities

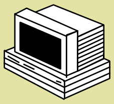
Outlines



Silhouettes



Realistic



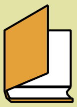
Other styles

(see Chapter 6 resemblances)

Familiar symbols

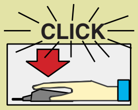
Help

Physical objects

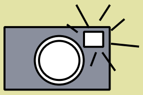


Documentation

Actions

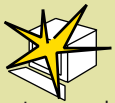


Results of actions



Picture taken

Events

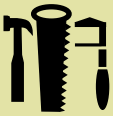


System crash

Causes of events

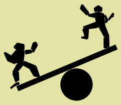
Paint

Tools



Fix problem

Metaphors

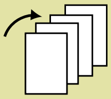


Dynamic balance

Associations

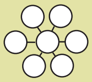
Information

Qualifiers



Location

Relationships



Related to center

States of a system

System error

Verbal Components of VLicons

Consistent naming principle

Use a consistent grammatical form and punctuation for similar verbal components of VLicons.

Applications to specific verbal components

Actions

- Use active verb (e.g. "receive message" rather than "message received").
- Place verb first usually (e.g. "send message").

Names

- Use common names (e.g. "PC" rather than "personal computer").
- Use shorter names rather than longer (e.g. "Spot II" for "Spotmobile II").
- Use noun or noun phrase (e.g. "Security Robot System").

Company, product, service, application

- Keep as simple as possible (e.g. "Spotmobile Corp." rather than "Spotmobile Robotics Corporation").
- Avoid uncommon abbreviations and acronyms if possible (e.g. "SRC" for "Spotmobile Robotics Corporation").

Capitalization

- Preferred: Capitalize only first word (unless proper name).
- All lowercase is OK.

To shorten labels

If you have to omit words, here is a priority list.

1. Omit articles such as "a, an, the." (e.g. Change "the server" to "server".)

2. Omit conjunctions such as "for, and, or." Suggestion: substitute a slash ("/"). (e.g. Change "server for network" to "network server".)

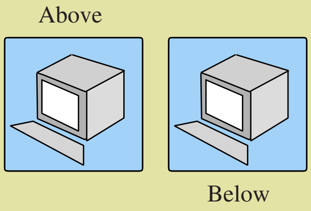
3. Omit prepositions such as "above, below, at, in , of, on, in front, behind." (e.g. Change "Server in hq" to "Hq server.")

4. Abbreviate longer words if possible. (e.g. Change "Headquarters server" to "Hq server.")

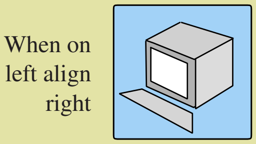
5. Above all, test the label.

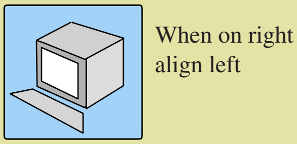
Verbal component location

Place the label of the VLicon above or below if possible.

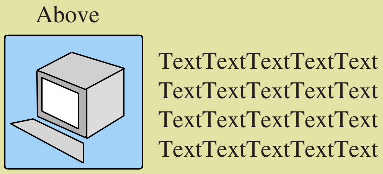


When design requires, label may be placed on right or left.

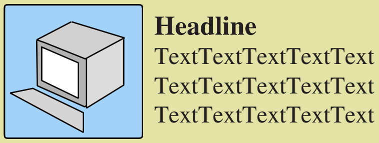

When on left align right


When on right align left

When integrating with blocks of text, align close to top of first paragraph.



If a headline or label is used in block of text, VLicon label may be omitted.



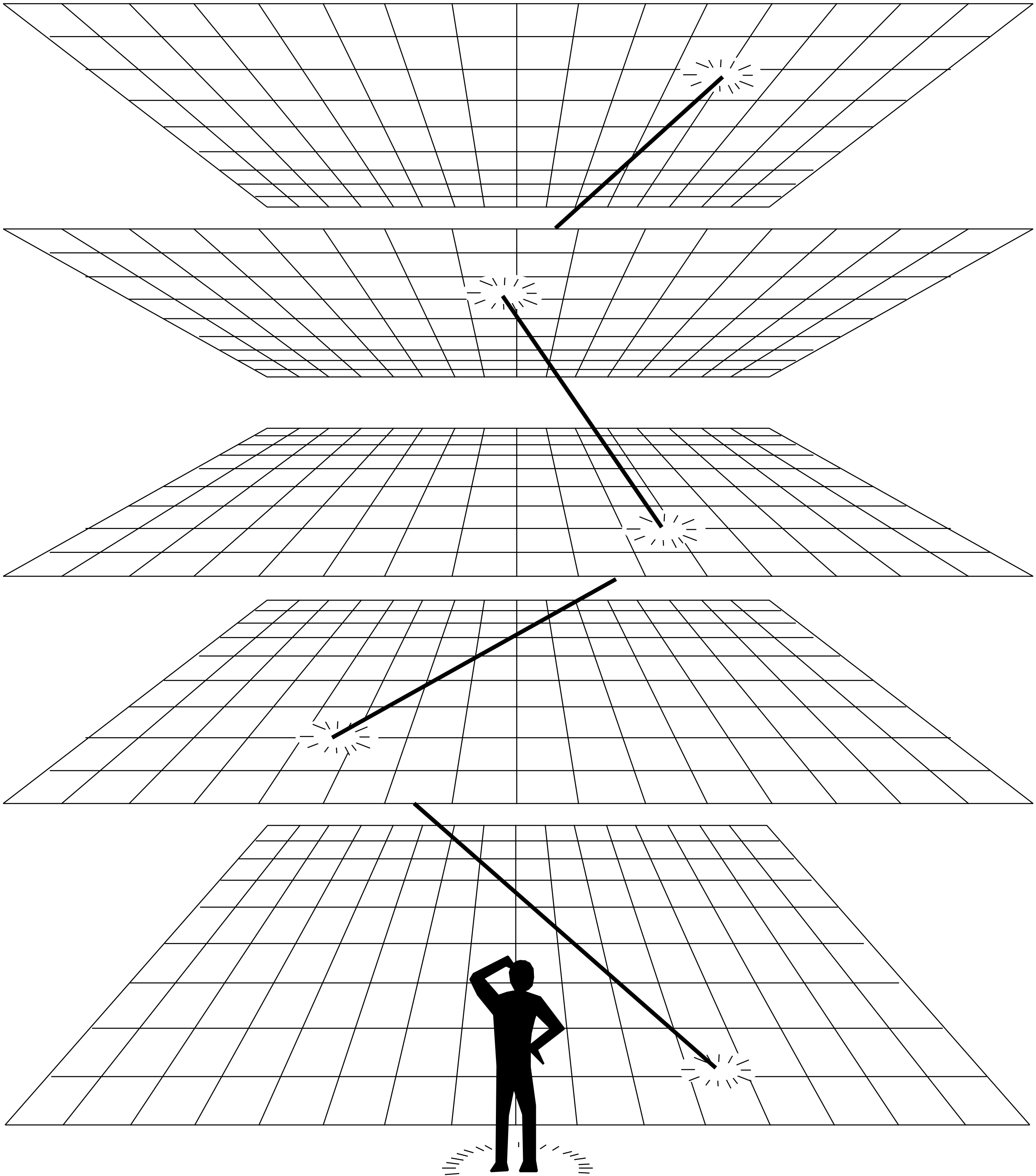
Punctuation

- Avoid periods, exclamation points, colons, and semicolons whenever possible.
- Question marks are OK if needed.
- Slashes (/) or dashes (-) OK if needed.
- Avoid parentheses if possible.

Chapter 5

Diagram Prototypes™

Structure, Organization, Motion, Change, Causality

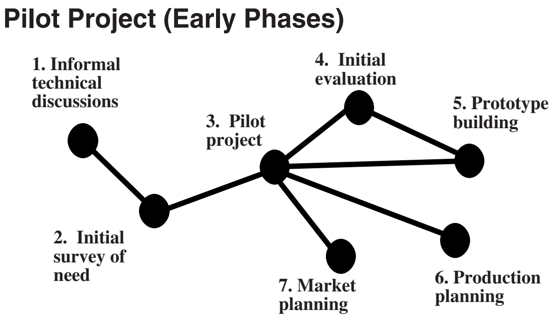


Plans / Projects—Diagram Prototypes

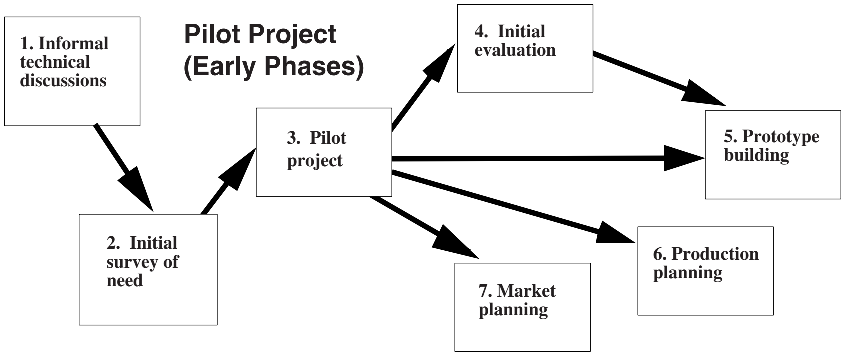
Verbal elements → **Names of phases**

Visual elements ↓

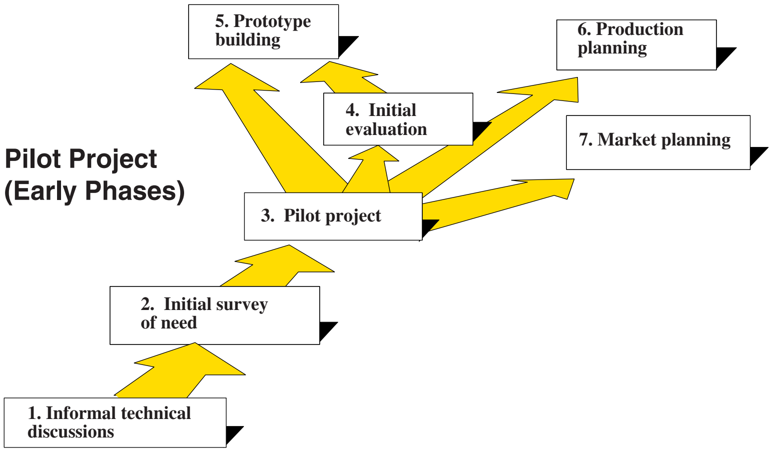
Lines and nodes



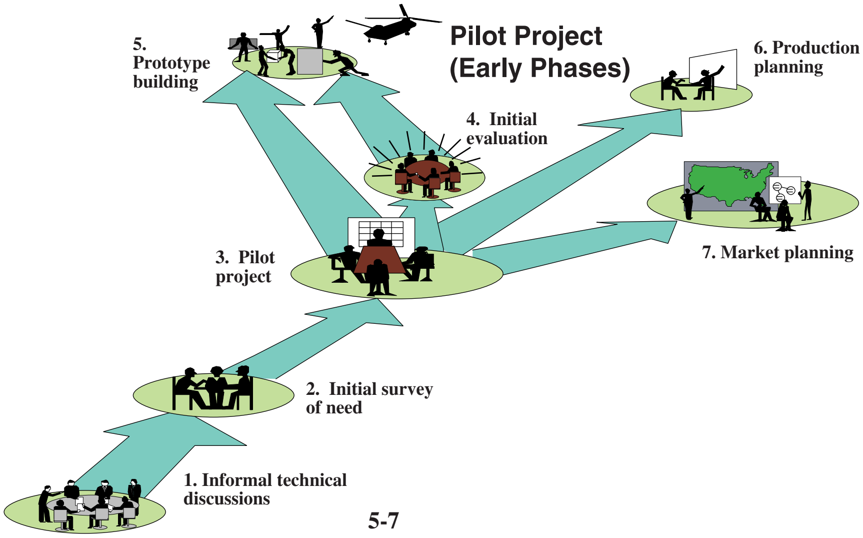
Shapes and lines or arrows



3-D Shapes and arrows



Icons



Structural/Organizational Diagrams

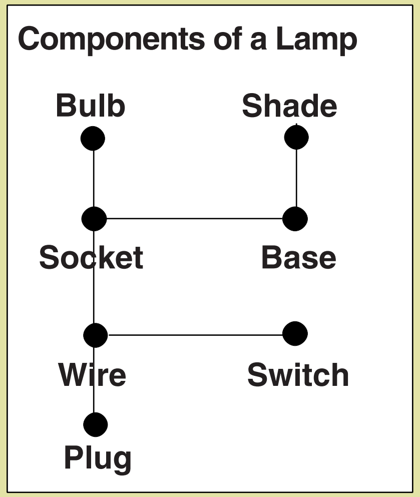
Verbal elements →

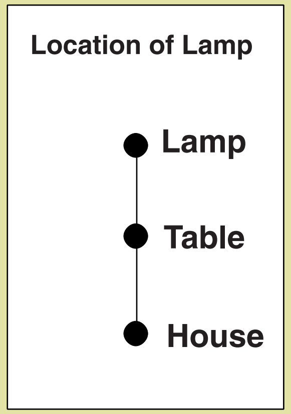
Names of objects/systems/parts

Description of structure and location/wholes

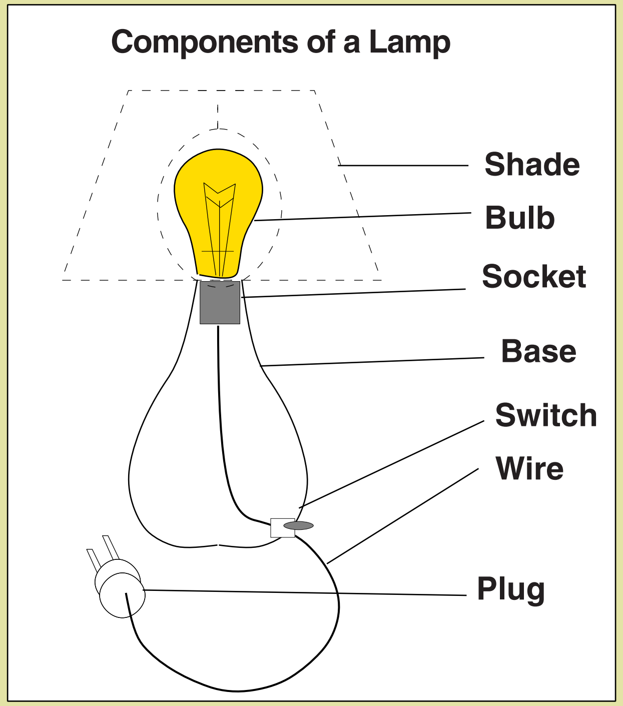
Visual elements

Lines and nodes

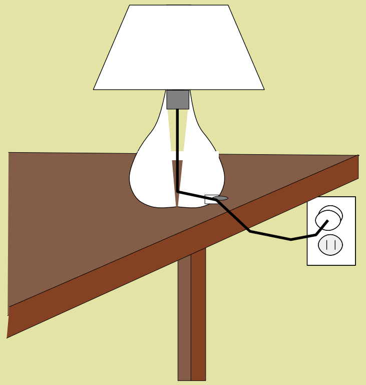

Components of a Lamp

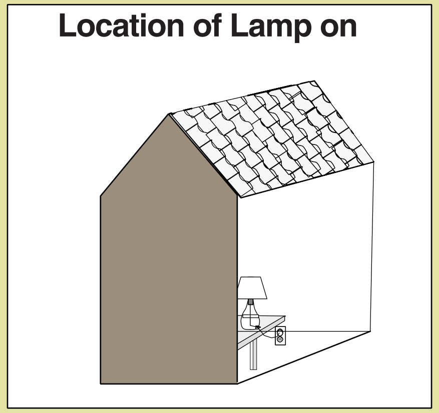

Location of Lamp

Resemblances


Components of a Lamp

Location of Lamp on Table




Location of Lamp on

Note: The lamp is intended to be prototypical of any piece of equipment treated as a system.

Structural/Organizational Diagrams

Description of structure and location/parts/connection

Description of composition

Description of functions/roles

Location of Parts of Lamp

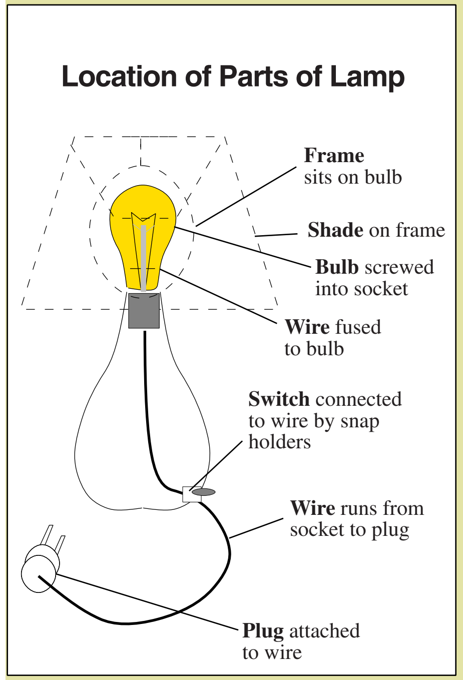
Frame	sits on bulb
Shade	on frame
Bulb	screwed into socket
Wire	fused to bulb
Socket	attached to top of base
Switch	connected to wire by snap holders
Base	on table
Wire	from socket to plug
Plug	attached to wire

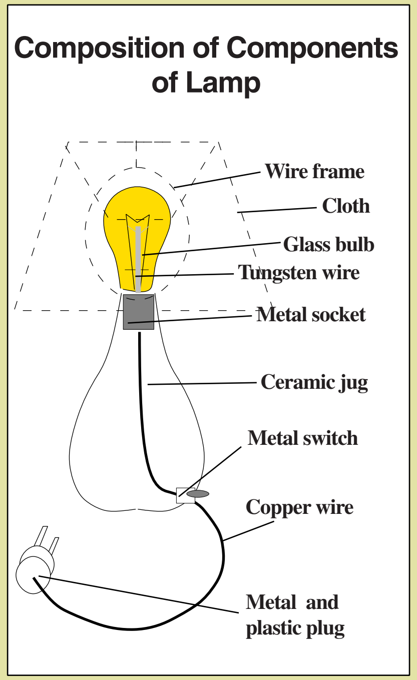
Composition of Components of Lamp

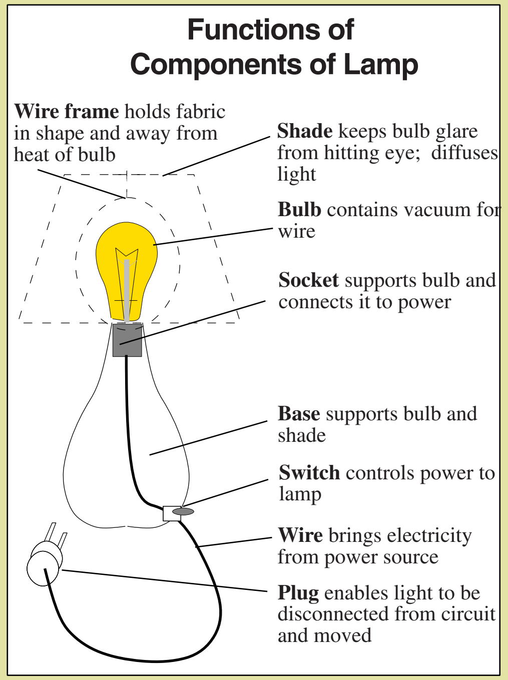
Frame	Wire
Shade	Fabric
Bulb	Glass
Wire	Tungsten
Socket	Metal
Switch	Metal and plastic
Base	Ceramic
Wire	Copper
Plug	Metal and plastic

Functions of Components of Lamp

Frame	holds fabric in shape and away from heat of bulb
Shade	keeps bulb glare from hitting eye; diffuses light
Bulb	contains vacuum for wire
Wire	source of light
Socket	supports bulb and connects it to power
Switch	controls power to lamp
Base	supports bulb and shade
Wire	brings electricity from power source
Plug	enables light to be disconnected from circuit and moved


Location of Parts of Lamp


Composition of Components of Lamp


Functions of Components of Lamp
Wire frame holds fabric in shape and away from heat of bulb
Shade keeps bulb glare from hitting eye; diffuses light
Bulb contains vacuum for wire
Socket supports bulb and connects it to power
Base supports bulb and shade
Switch controls power to lamp
Wire brings electricity from power source
Plug enables light to be disconnected from circuit and moved

When to Use Different Levels

IF you need to . . .	**THEN use this visual level . . .**
quickly identify • parts or subsystems • locations • components • compositions • functions	lines and nodes
give feel of two or three dimensions	boxes and arrows or 3-D shapes
show • whole or part • detail of resemblance • parts in location	resemblances
show context	resemblances
emphasize parts and their connections or use icons later for other purposes (see functional semantics of icons job aid)	icons

Motion, Change, Causality

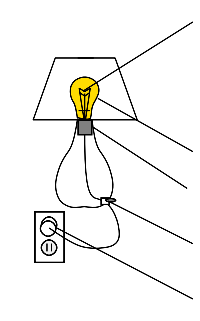
Image of Dynamics (on page or screen)

One-Panel

Verbal Elements

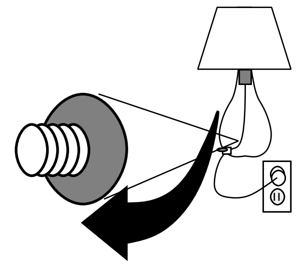
Changes in parts that characterize sequence or causality

What Happens When Light Goes On



Light rays radiate from the **filament** that glows when it is heated up by the electricity flowing when the **bulb** is screwed into the **socket** when the **switch** is turned on and the **plug** is inserted into the **outlet.**

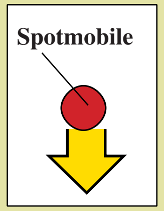
What Happens When Switch Turned on

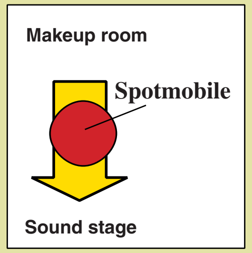


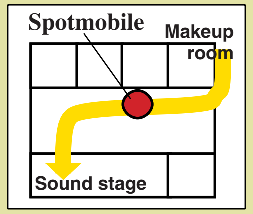
When the switch is rotated clockwise, the light goes on.

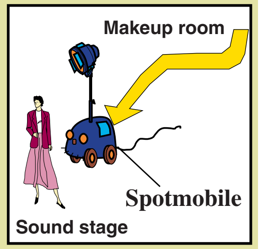
Motion, changes in location

Abstract			Resemblance
Mere movement of an object	Origination, destination, and direction of movement	Origination, destination, and direction of movement plus background or geographic area to scale	Origination, destination, and direction of movement







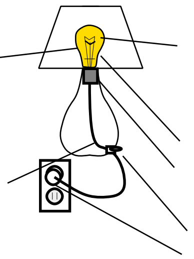


Descriptions of changes in state of system

What Happens When Lamp is Turned On

Time 1: Switch is off

Time 2: Switch is on



The **filament is cool.** No electricity flowing.

Switch is turned off.

Light rays radiate from the **filament** that glows when it is heated up by the electricity flowing when the **bulb** is screwed into the **socket** when the *switch is turned on* and the **plug** is inserted into the **outlet.**

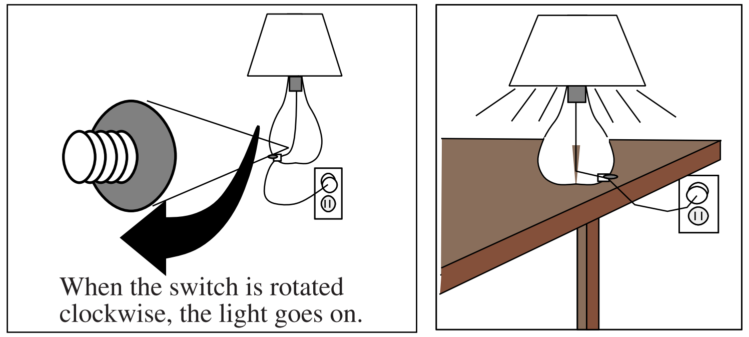
Elapsed time is indicated by text in single-panel diagrams.

Motion, Change, Causality

Two-Panel

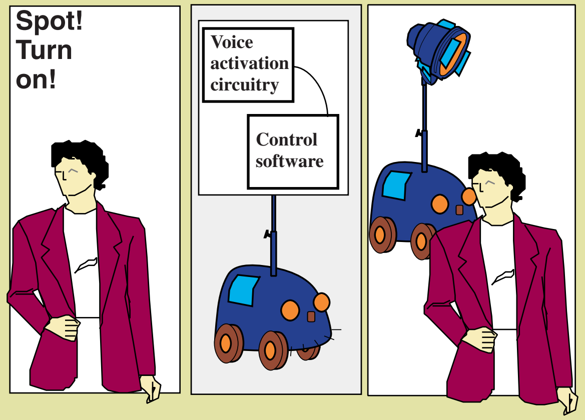
Multiple Panels

What Happens When Switch Turned On

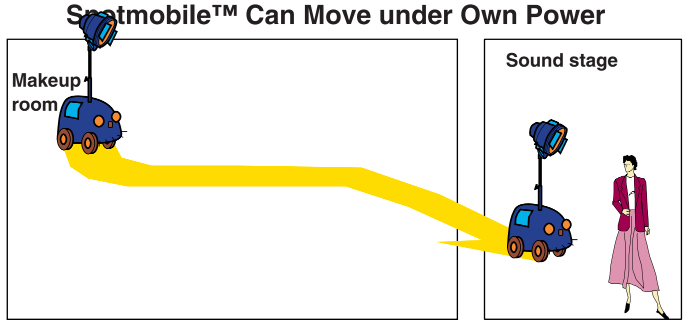


When the switch is rotated clockwise, the light goes on.

Spotmobile™ Is Voice-Controlled

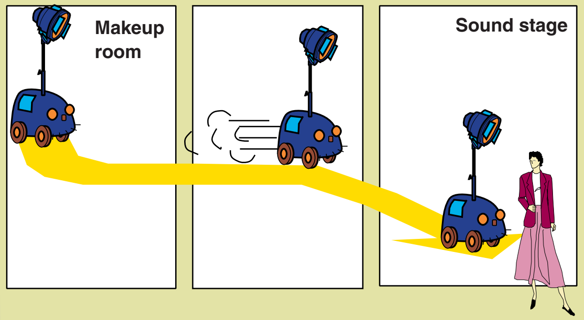


Spotmobile™ Can Move under Own Power



Spotmobile™ can move from any point to any other point under its own power.

Spotmobile™ Can Move under Own Power

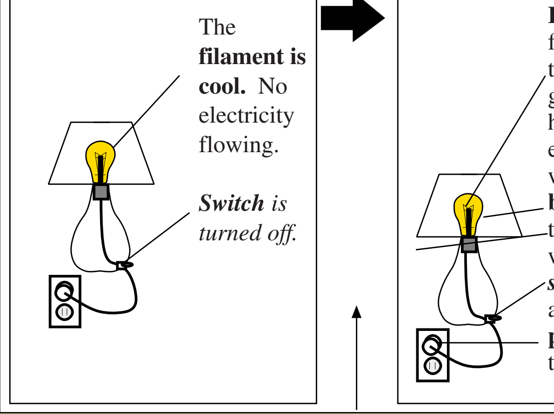


Spotmobile™ can move from any point to any other point under its own power.

What Happens When Lamp is Turned On

Time 1: Switch is off

Time 2: Switch is on

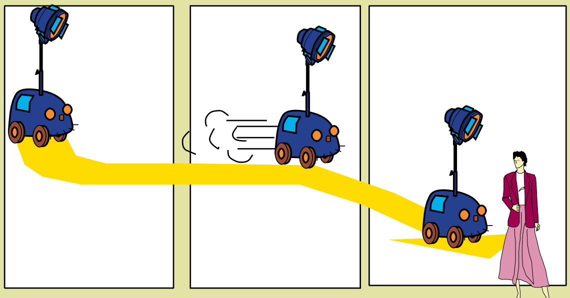


The **filament is cool.** No electricity flowing.

Switch is turned off.

Light rays radiate from the **filament** that glows when it is heated up by the electricity flowing when the **bulb** is screwed into the **socket** when the *switch is turned on* and the **plug** is inserted into the **outlet.**

What Happens When Spotmobile™ Is Summoned



Spotmobile™ in Park Mode.

Spotmobile™ summoned by remote control.

Spotmobile™ shines spot on star.

Elapsed time (shown as space between boxes) is very short and inconsequential for this diagram (i.e. for this level of explanation).

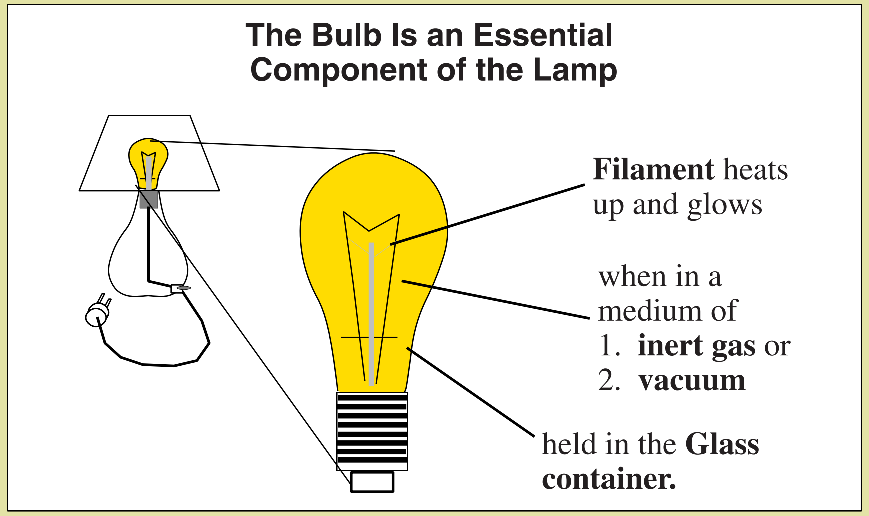
Motion, Change, Causality

Image of Dynamics
(on page or screen)

One-Panel

Verbal Elements

Changes in level of detail (higher or lower level)



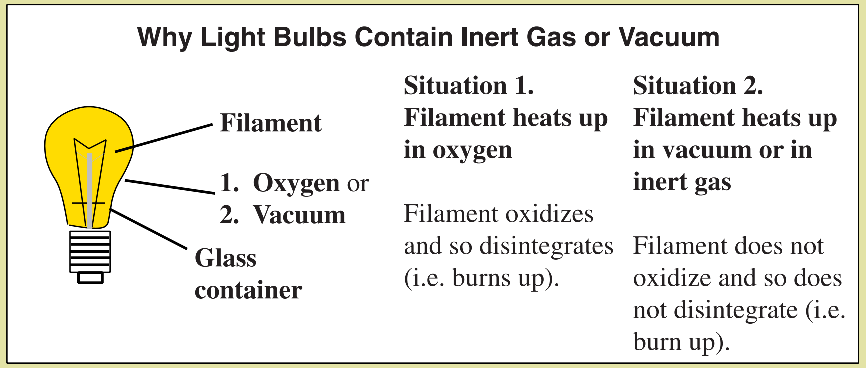
The Bulb Is an Essential Component of the Lamp

Filament heats up and glows

when in a medium of
1. **inert gas** or
2. **vacuum**

held in the **Glass container.**

Explanation (based on presence or absence of factors)



Why Light Bulbs Contain Inert Gas or Vacuum

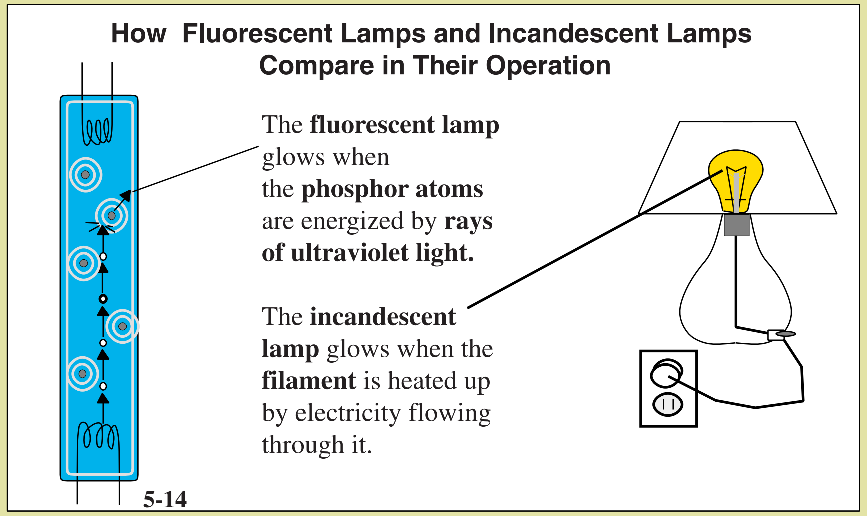
Situation 1. Filament heats up in oxygen

Filament oxidizes and so disintegrates (i.e. burns up).

Situation 2. Filament heats up in vacuum or in inert gas

Filament does not oxidize and so does not disintegrate (i.e. burn up).

Explanation (compare and contrast structures, processes, classification, concepts, facts, principles)



How Fluorescent Lamps and Incandescent Lamps Compare in Their Operation

The **fluorescent lamp** glows when the **phosphor atoms** are energized by **rays of ultraviolet light.**

The **incandescent lamp** glows when the **filament** is heated up by electricity flowing through it.

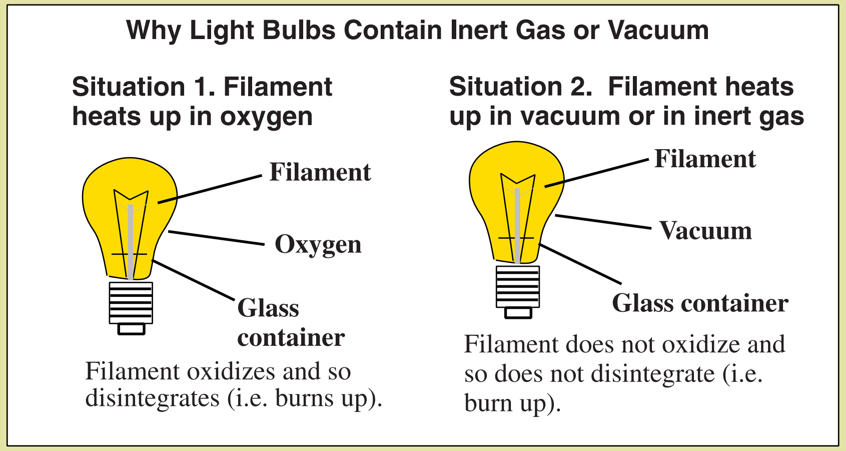
Motion, Change, Causality

Two-Panel

Three-Panel

Not shown on this job aid

Not shown on this job aid



Why Light Bulbs Contain Inert Gas or Vacuum

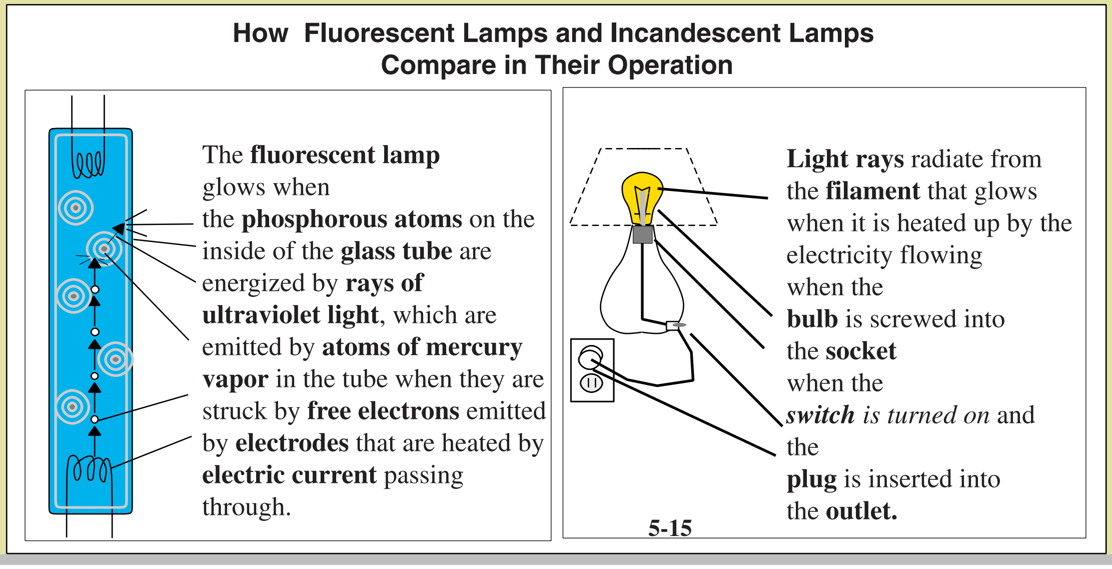
Situation 1. Filament heats up in oxygen

Filament oxidizes and so disintegrates (i.e. burns up).

Situation 2. Filament heats up in vacuum or in inert gas

Filament does not oxidize and so does not disintegrate (i.e. burn up).

Not shown on this job aid



How Fluorescent Lamps and Incandescent Lamps Compare in Their Operation

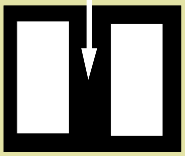
The **fluorescent lamp** glows when the **phosphorous atoms** on the inside of the **glass tube** are energized by **rays of ultraviolet light**, which are emitted by **atoms of mercury vapor** in the tube when they are struck by **free electrons** emitted by **electrodes** that are heated up by **electric current** passing through.

Light rays radiate from the **filament** that glows when it is heated up by the electricity flowing when the **bulb** is screwed into the **socket** when the ***switch*** *is turned on* and the **plug** is inserted into the **outlet.**

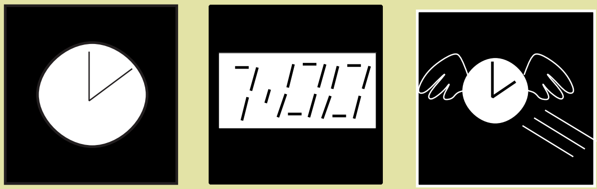
Not shown on this job aid

Time: Showing Intervals

1. Space between frames

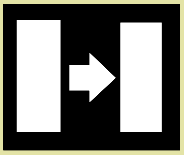


2. Clocks



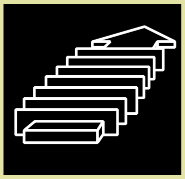
3. Words

4. Arrow

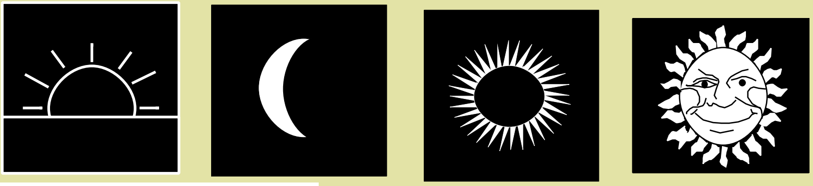


5. Calendars

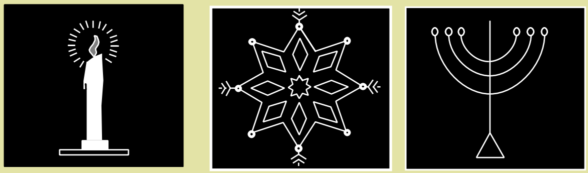
6. Popp (Project Organization Process Procedure) arrows



7. Icons for natural events

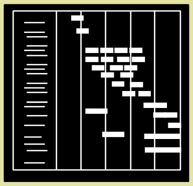


8. Icons for holidays and seasons



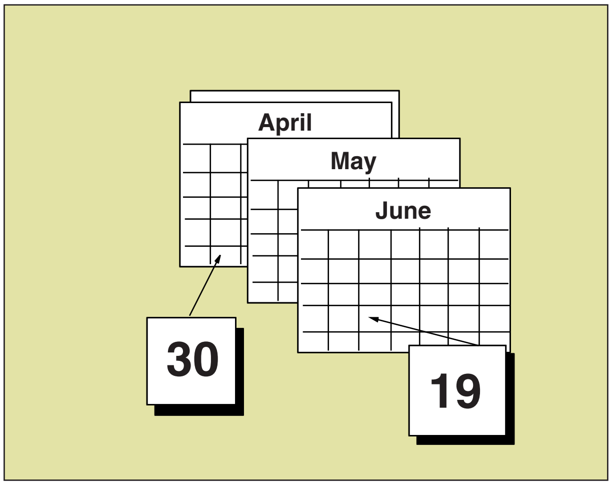
9. Weather or seasonal change

10. Gantt charts and schedules

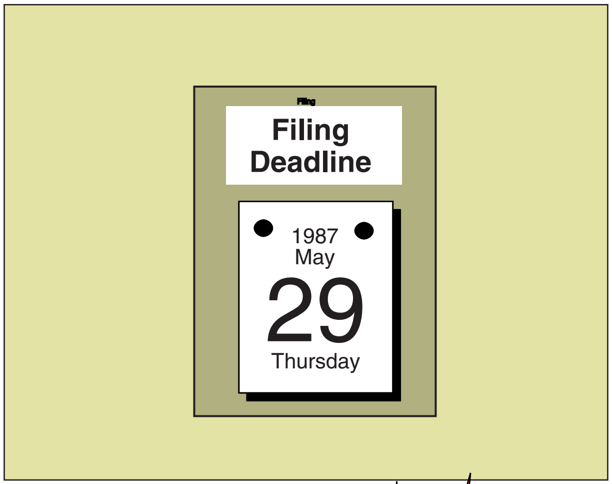


Time: Showing Important Dates

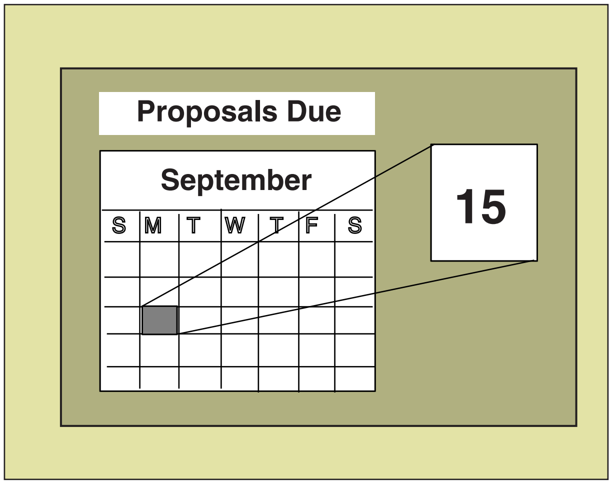
Use arrows and calendars



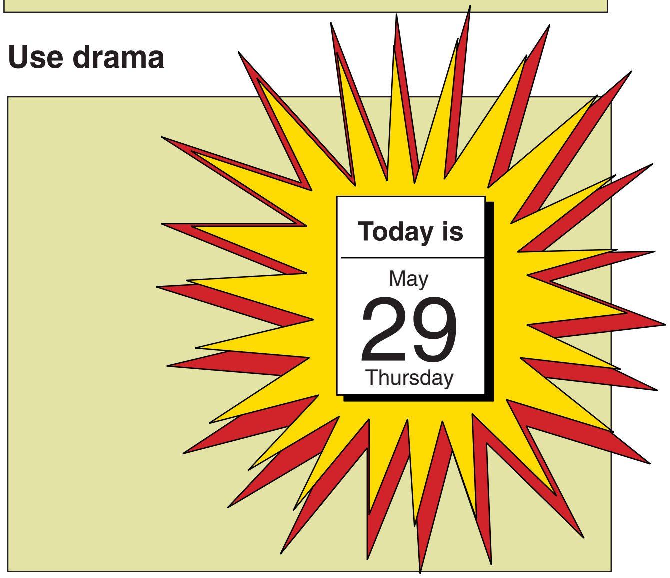
Use desk calendars



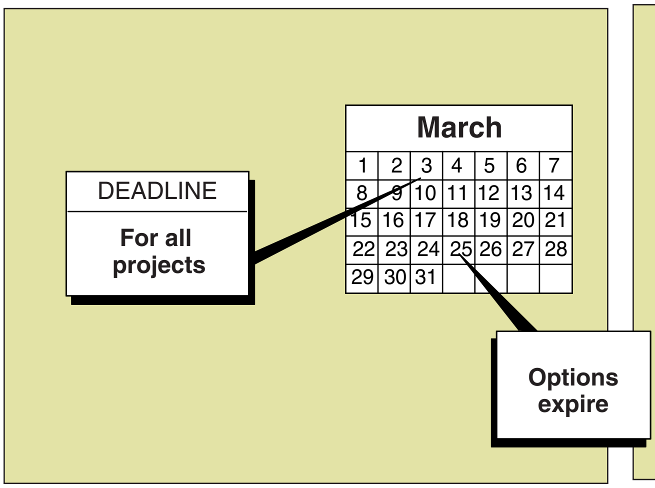
Use pop-outs



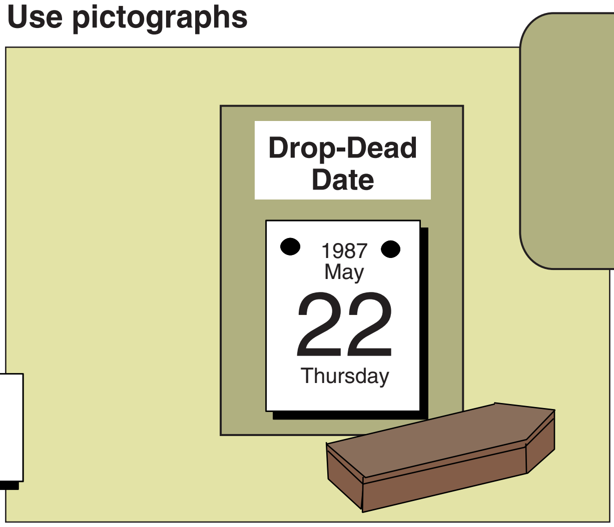
Use drama



Use posters and arrows

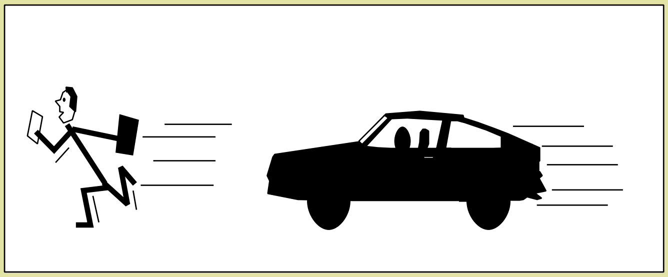


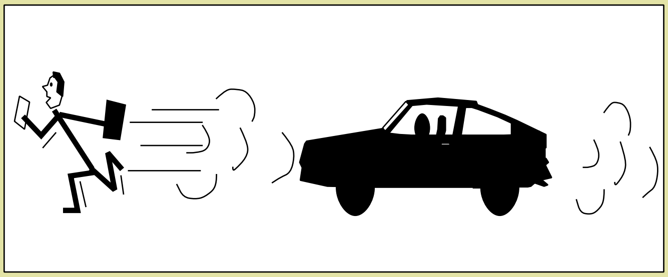
Use pictographs



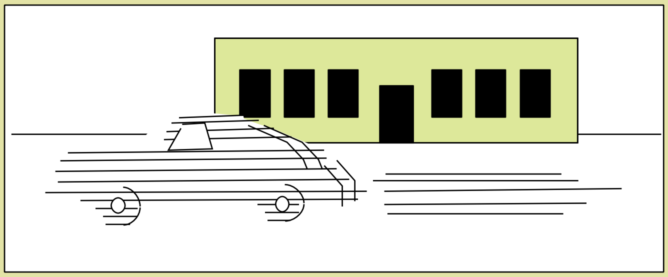
Motion—1

"Motion" lines

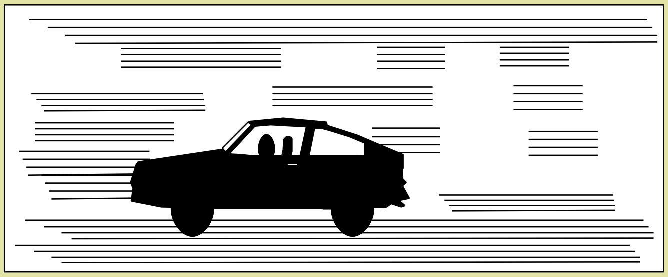




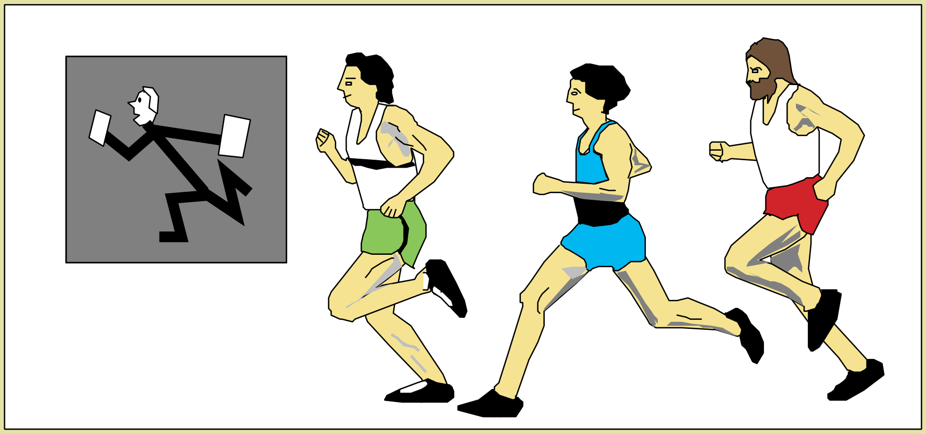
Blurred figures or objects in foreground



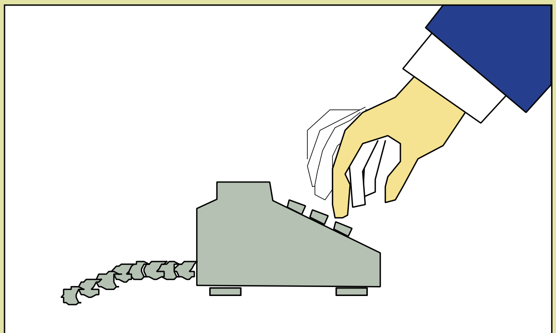
Blurred backgrounds



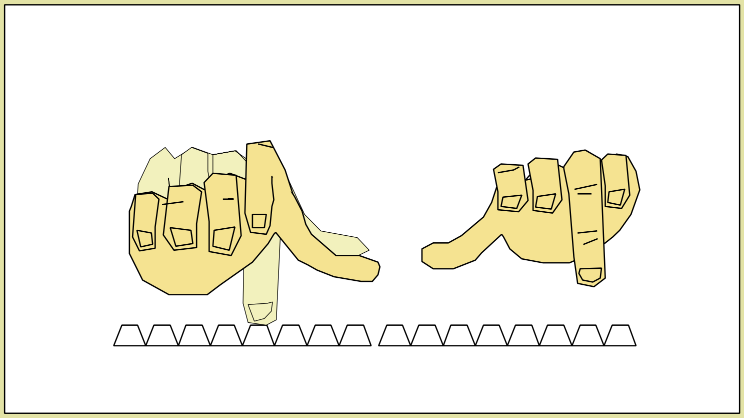
Positons of movement for animals and people



Multiple overlapping images

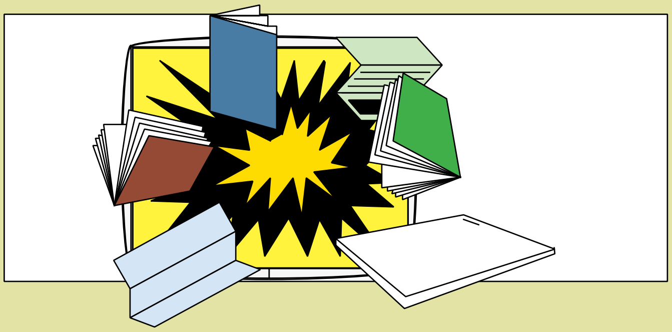


Note: This is somewhat like a time exposure on a phtograph.

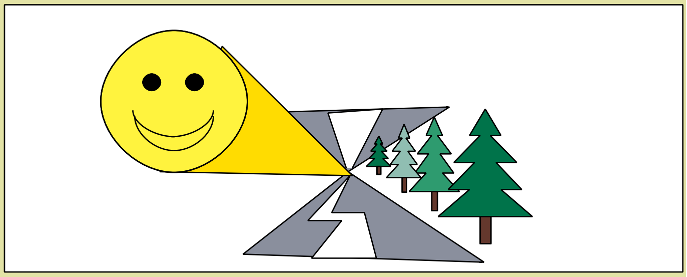


Motion—2

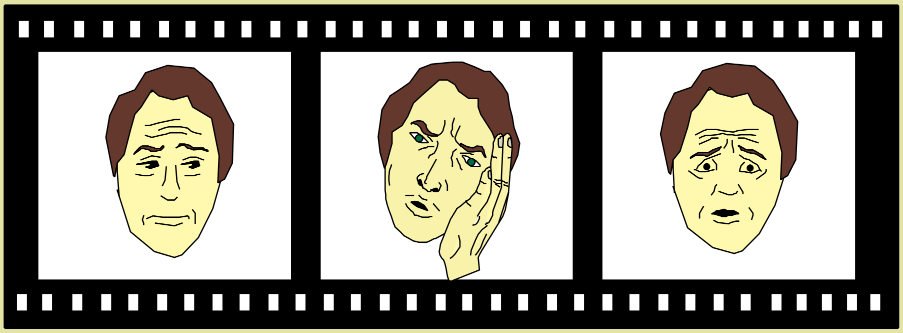
Images bursting out of frame



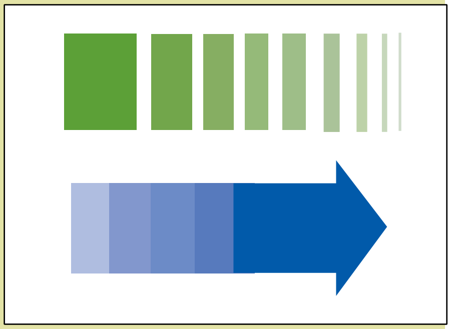
Images coming at reader from one-point perspective



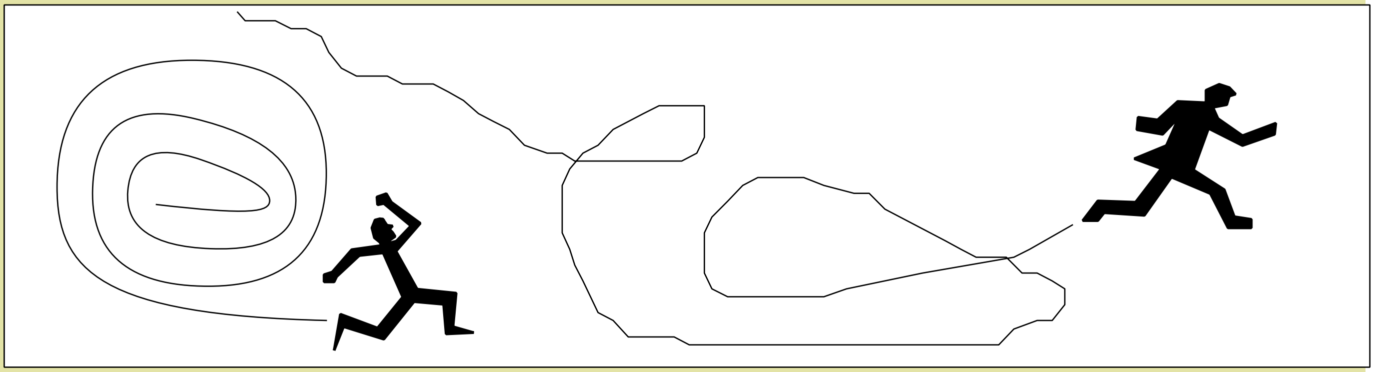
Multiple images with film strip convention



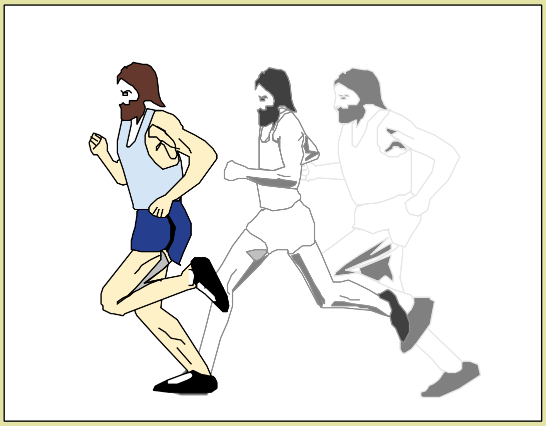
Shading



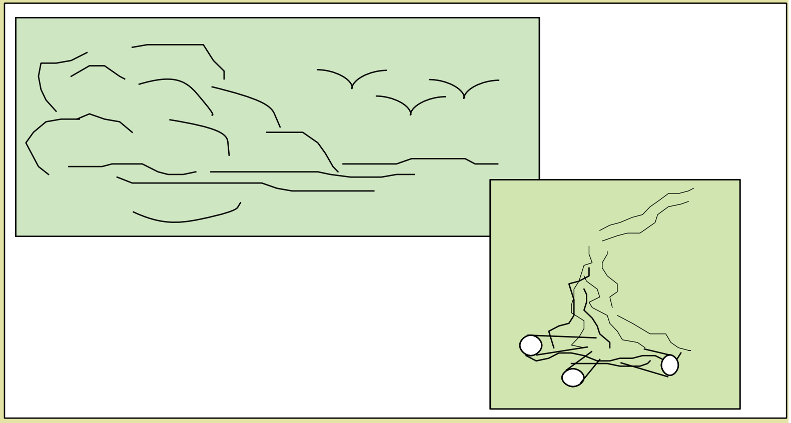
Lines to indicate paths of motion



Fuzzy outlines and blurring

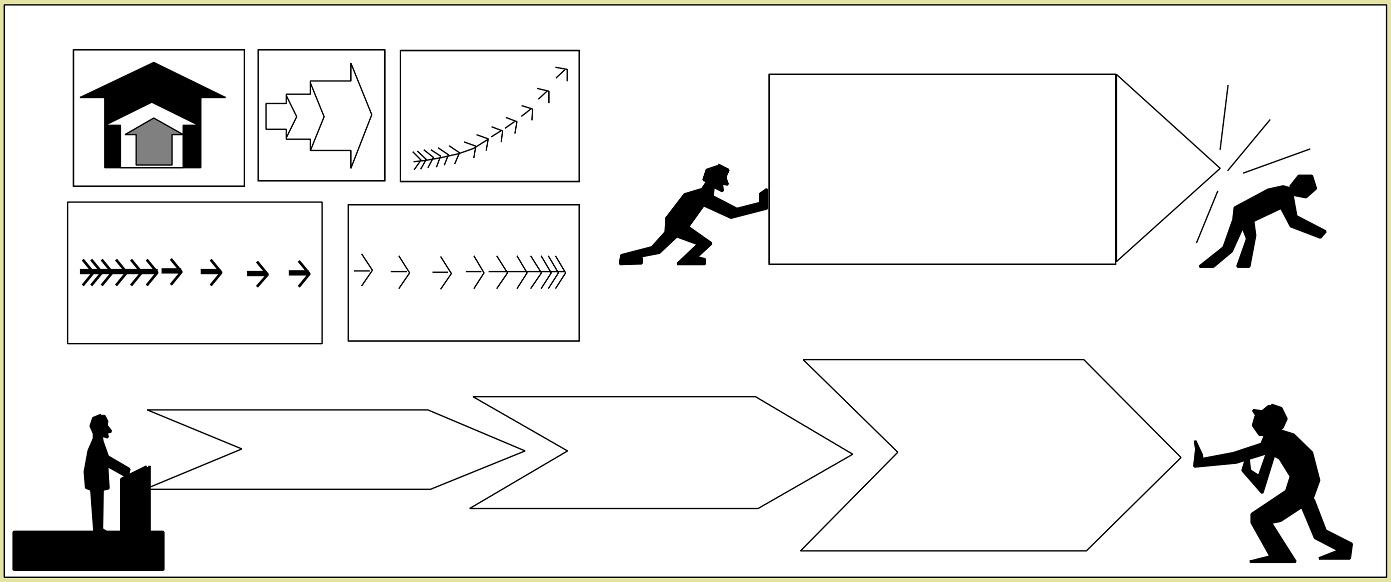


Suggestions of natural phenomena that are usually in motion



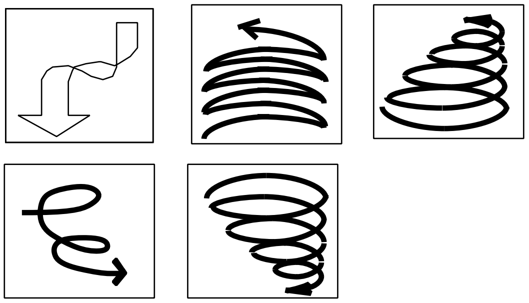
Motion—3

Arrows

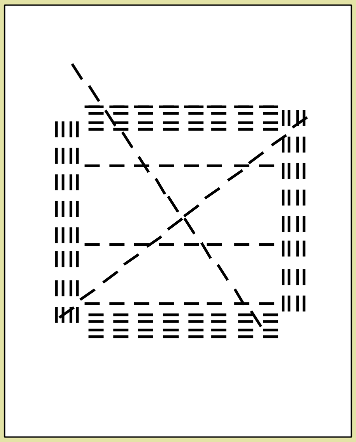


Composition and lines

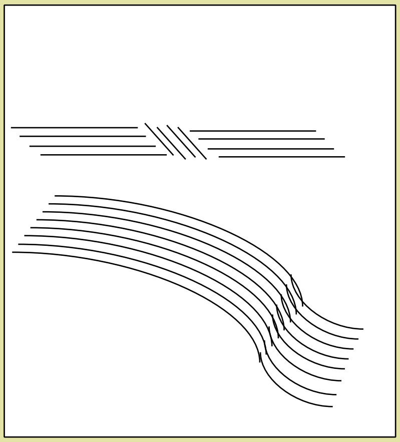
Note: Twisting, turning, entwining almost force the eye to imagine movement.



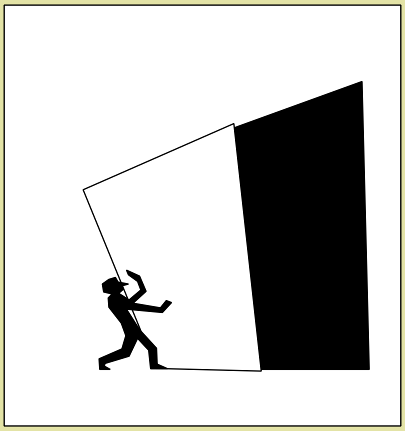
Dashed lines



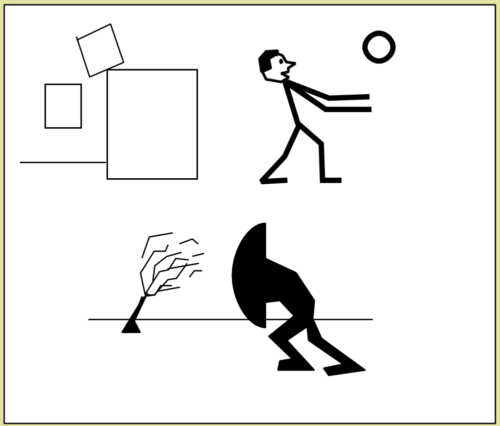
Pattern changes



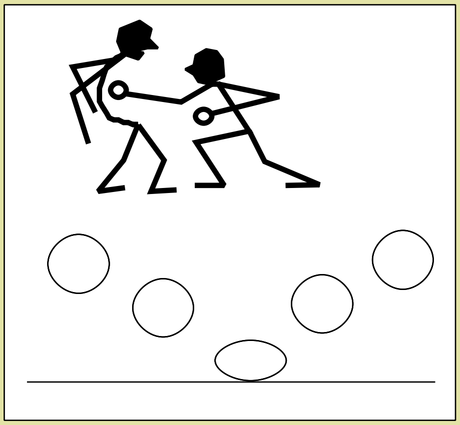
Distortions in shape



Natural motions or physical laws that suggest movement

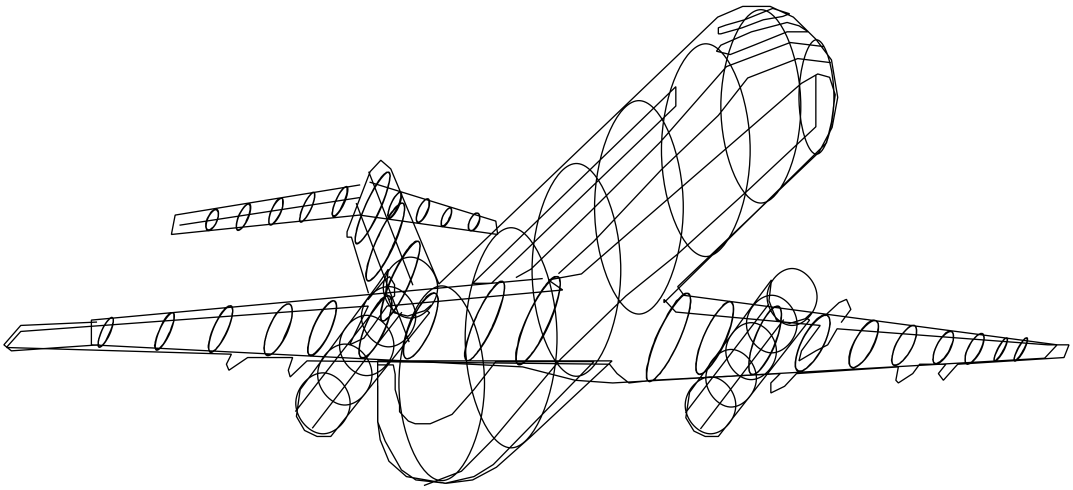


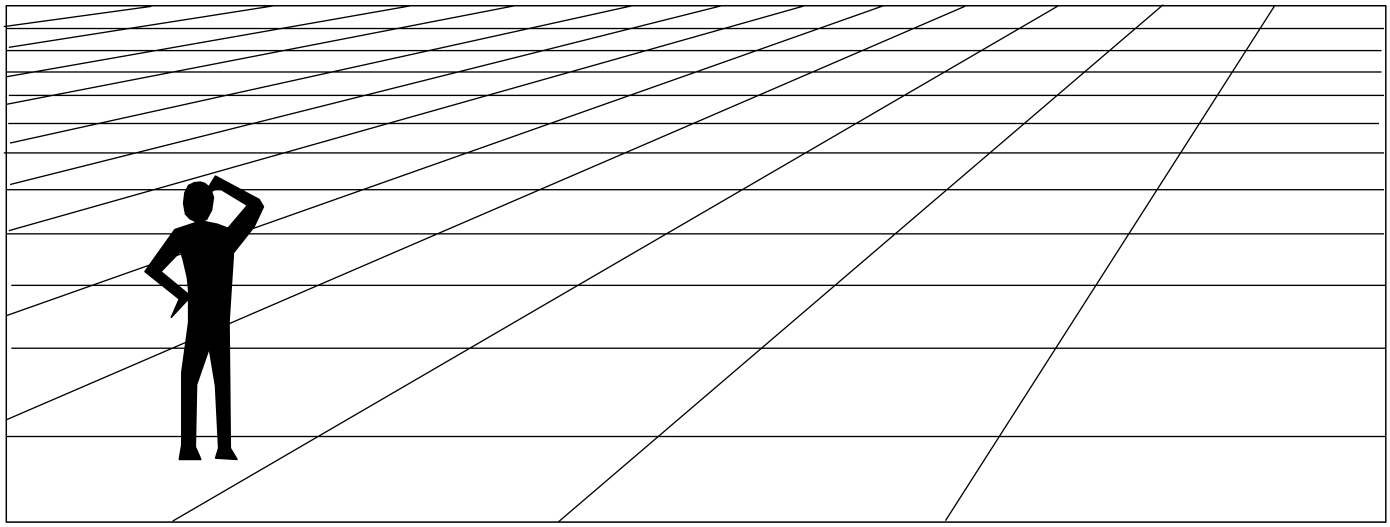
Distortion of natural motions



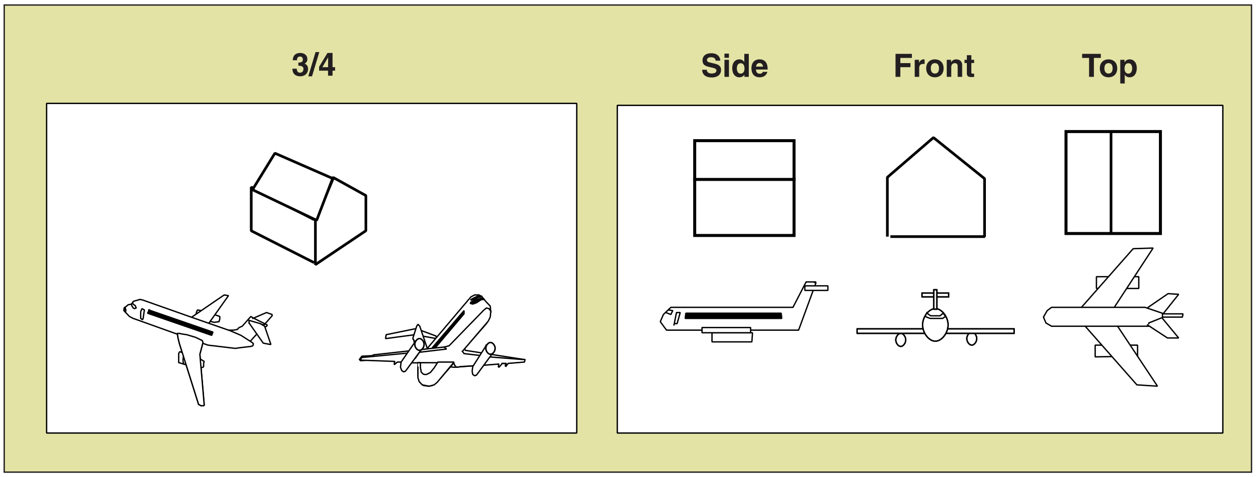
Chapter 6

Resemblances

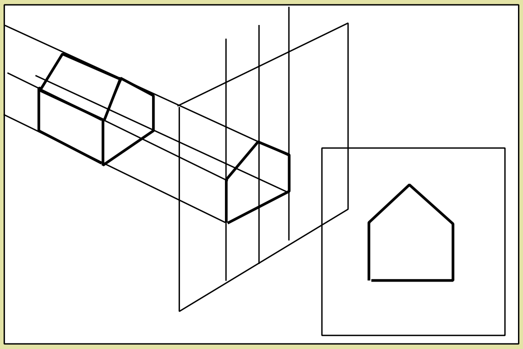




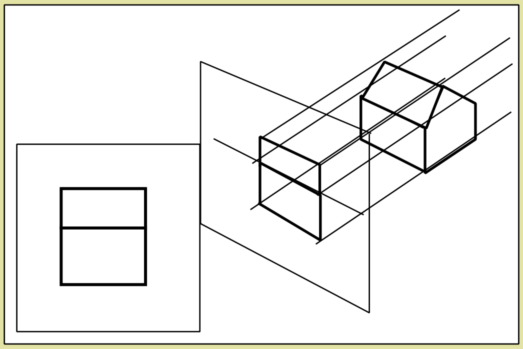
Point of View



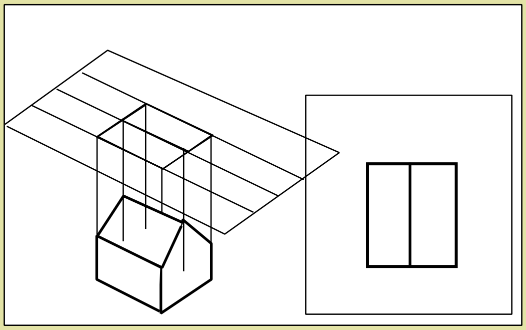
Front projection

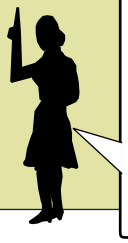


Side projection



Top projection





Guidelines for selecting point of view

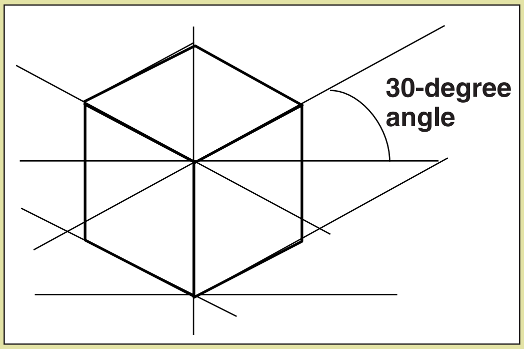
- Show it from the point of view of the user.
- Show it from a familiar point of view.
- Explain point of view with words, if necessary.
- Use item of background to give orientation.
- Avoid odd points of view unless necessary to show location of part.

Other guidelines

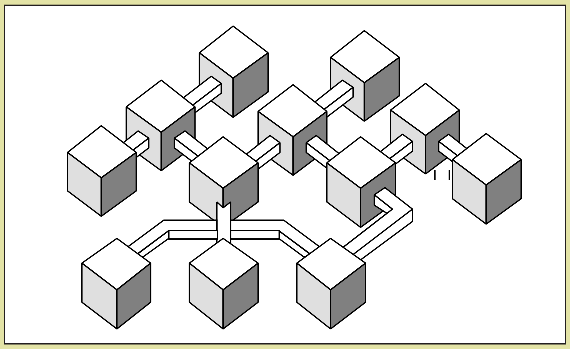
- Put in person for scale.
- Put in familiar objects or backgrounds of scale.
- 3/4 view is particularly useful, even slight 3/4.
- Avoid points of view that do not exist (at least from the point of view of the observer, e.g., a drawing of the bottom of this overhead projector).

Types of Geometric Projection

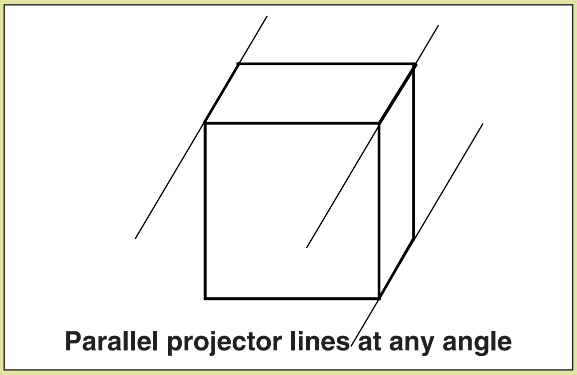
Isometric (axonometric) projections



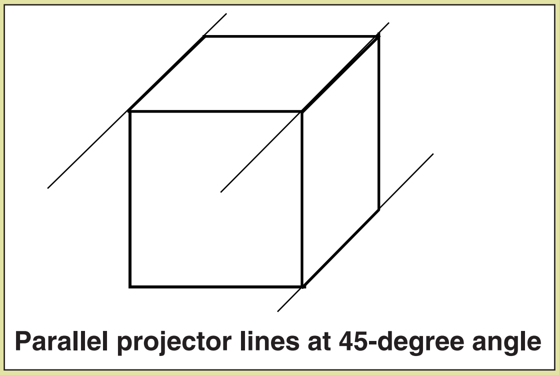
Flowchart in isometric projection



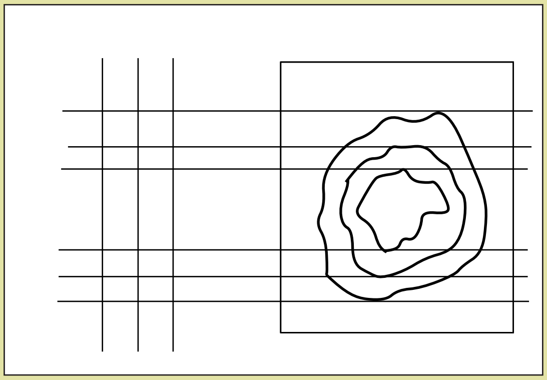
Clinographic (oblique) projection



Cavalier (cabinet, military) projection

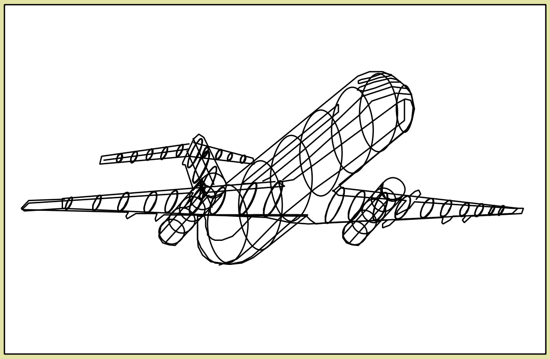


Contour projection

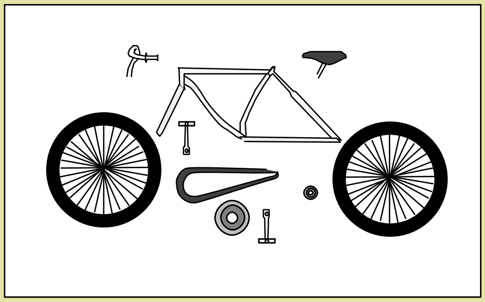


Internal Structure and Parts

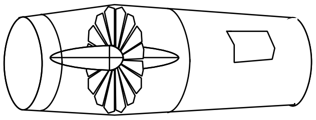
Wireframe



Exploded

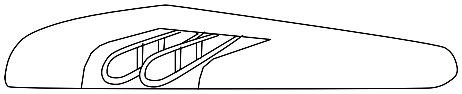


Ghosted diagram

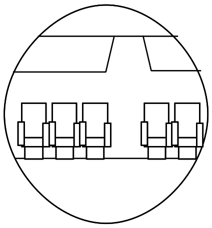


Ghosted diagram of engine turbine

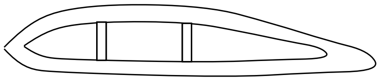
Cutaway diagram



Cross section

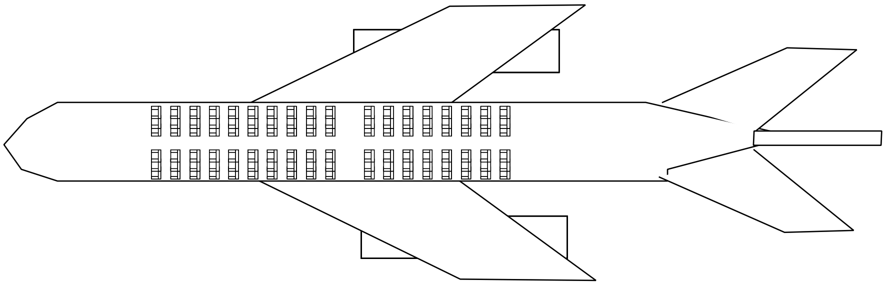


Cross section of fuselage



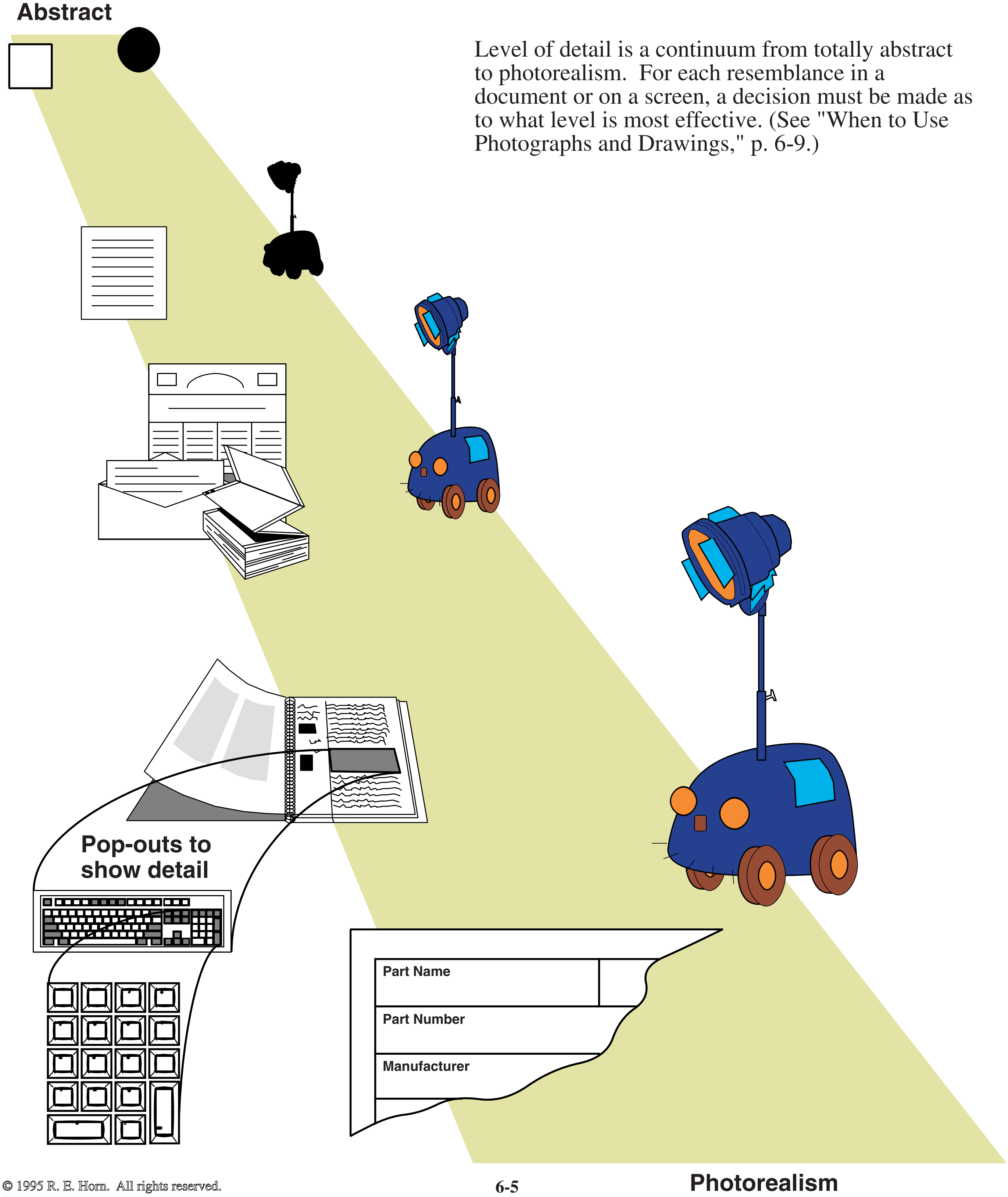
Cross section of wing

Internal Plan



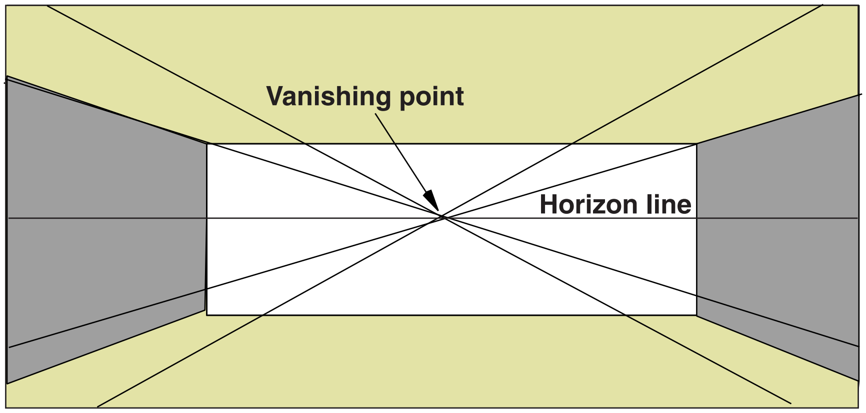
Level of Detail

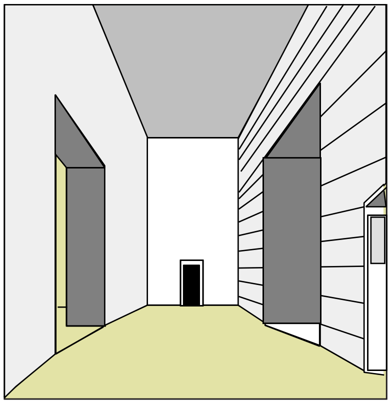
Level of detail is a continuum from totally abstract to photorealism. For each resemblance in a document or on a screen, a decision must be made as to what level is most effective. (See "When to Use Photographs and Drawings," p. 6-9.)



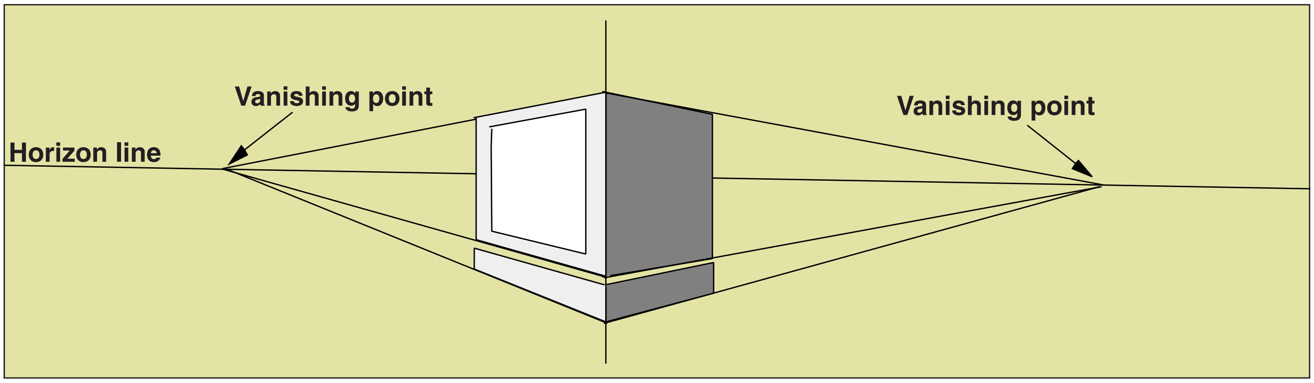
Perspective Projections

One-point perspective

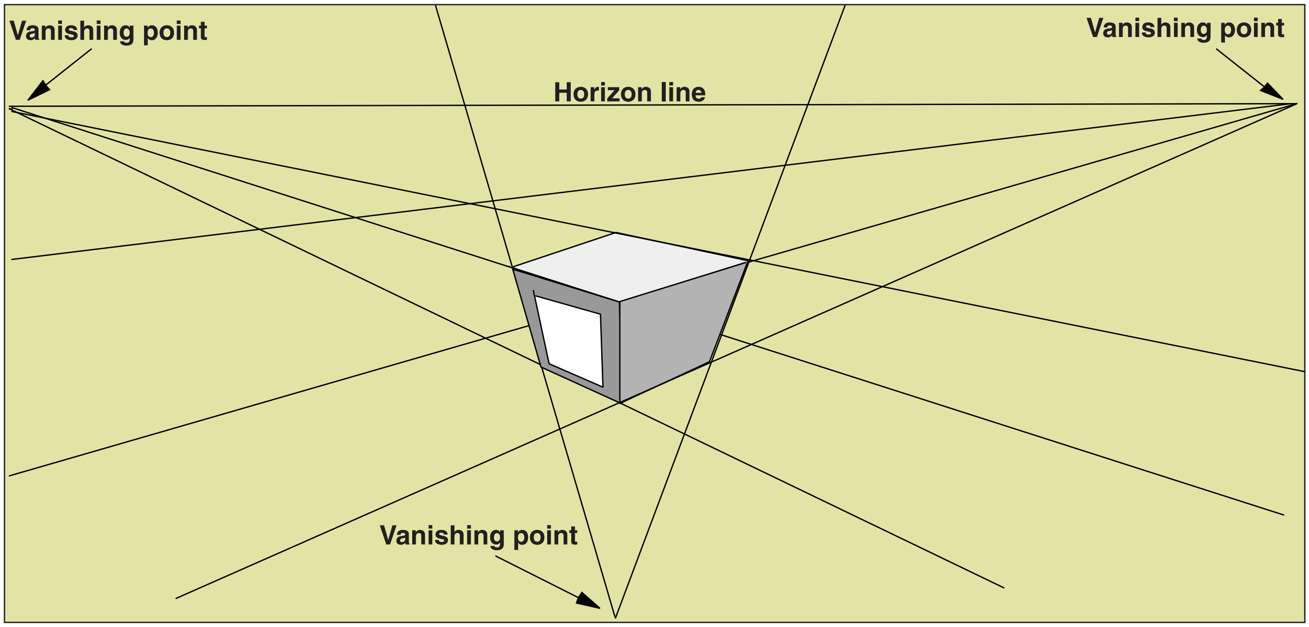




Two-point perspective

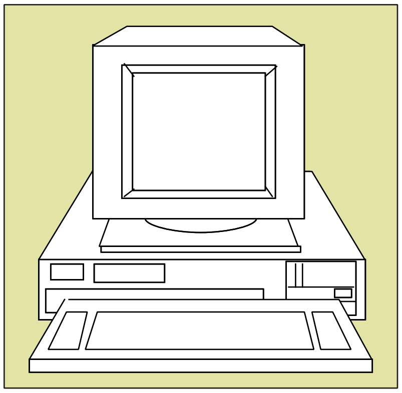


Three-point perspective

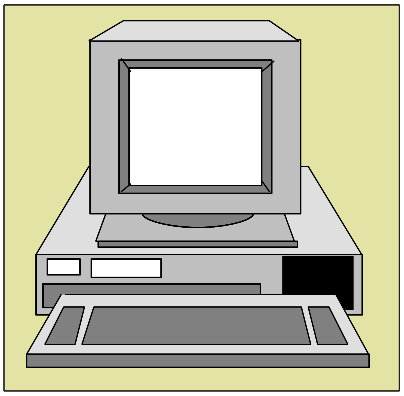


Styles and Method of Rendering

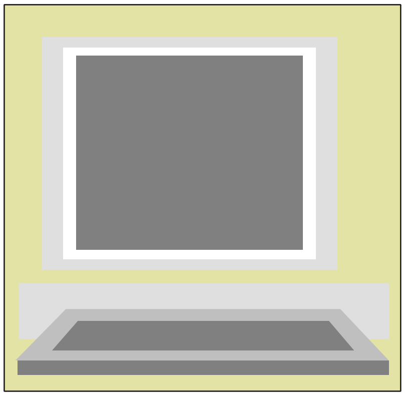
Line drawing



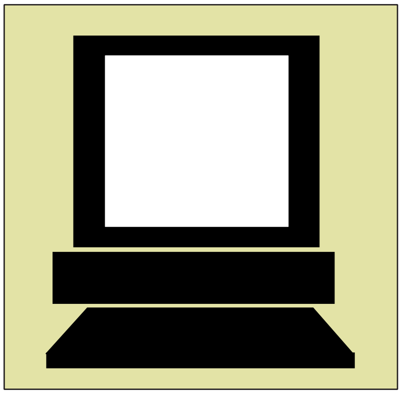
Line drawing with gray fill



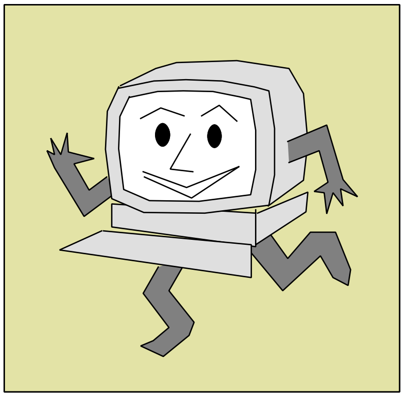
Soft edge



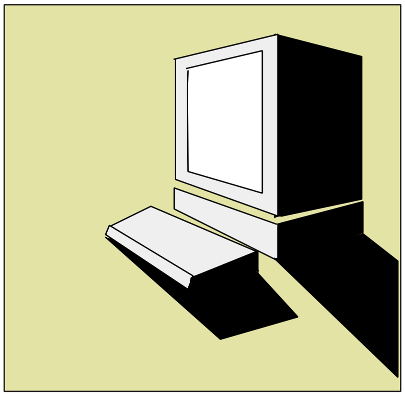
Silhouette



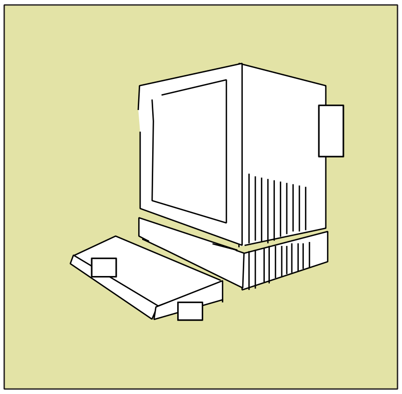
Cartoon



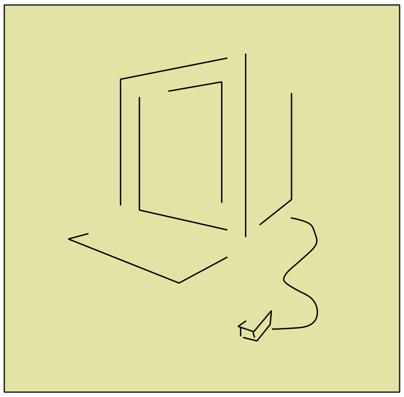
Strong shadows



Pen and ink

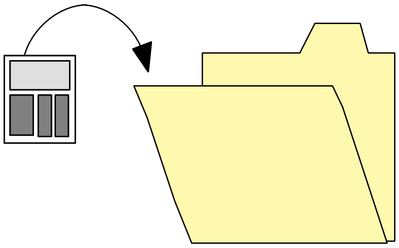


Suggestive



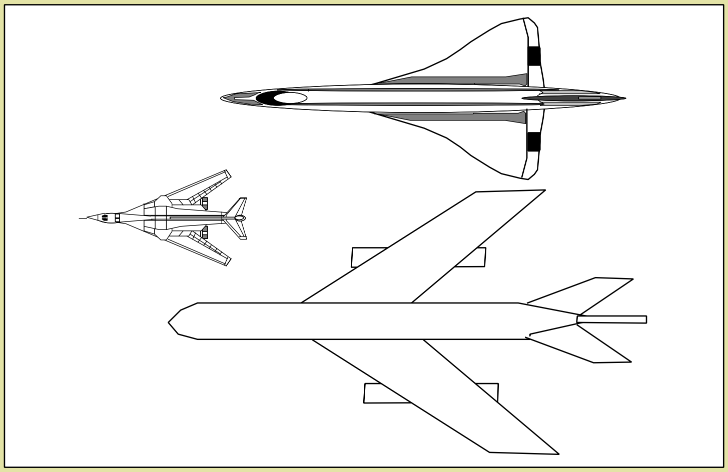
Lesson

There are numerous different styles, many of which have no names. Keep a "style file" of clippings you like or think you might need in order to communicate with a graphic artist.

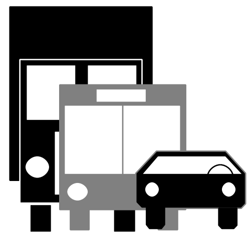


Measurements

Measurements by comparison of size



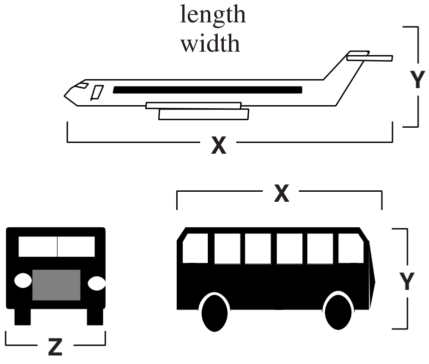
How do sizes compare?



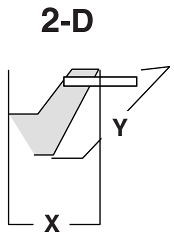
Measurement (metrics)

Size

height
length
width

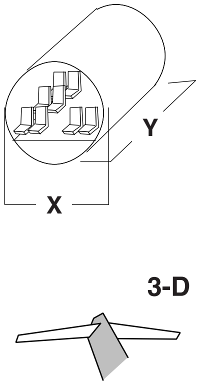


Area

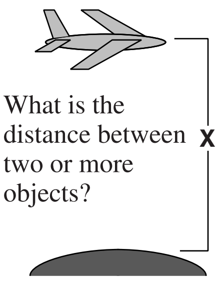


Gray indicates area of interest.

Volume

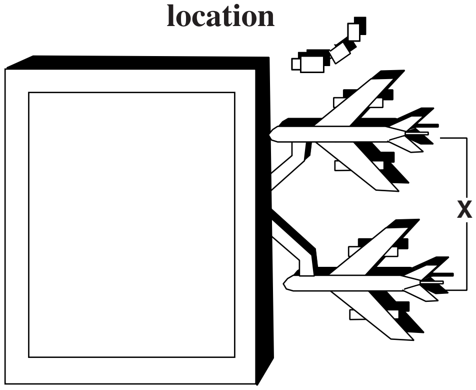


Distance between two or more objects

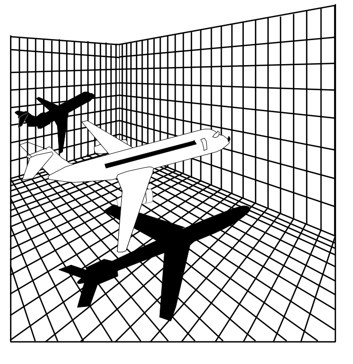


What is the distance between two or more objects?

Against geographical location

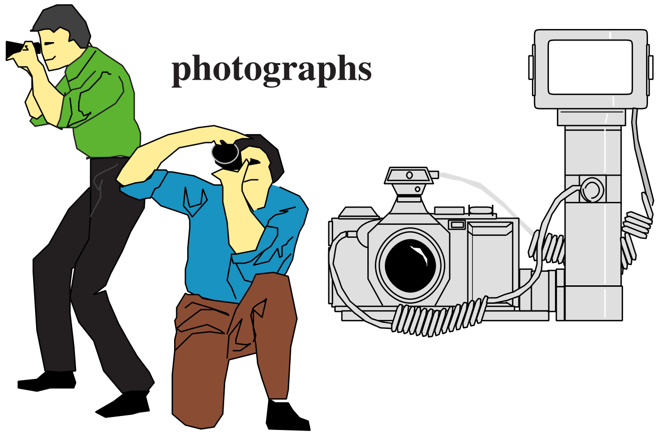
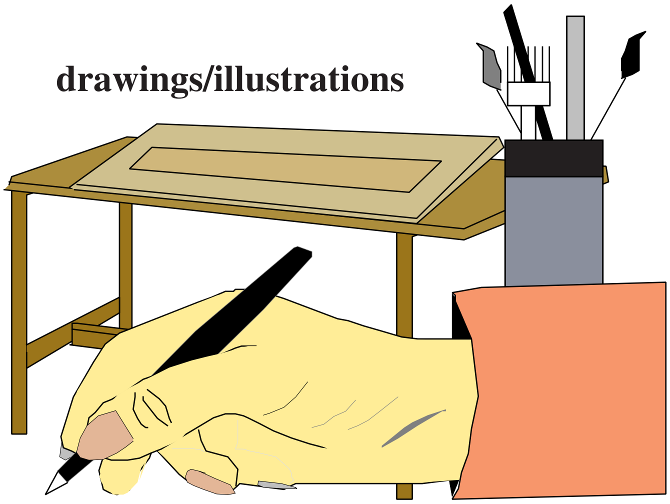


Measurement against background grid



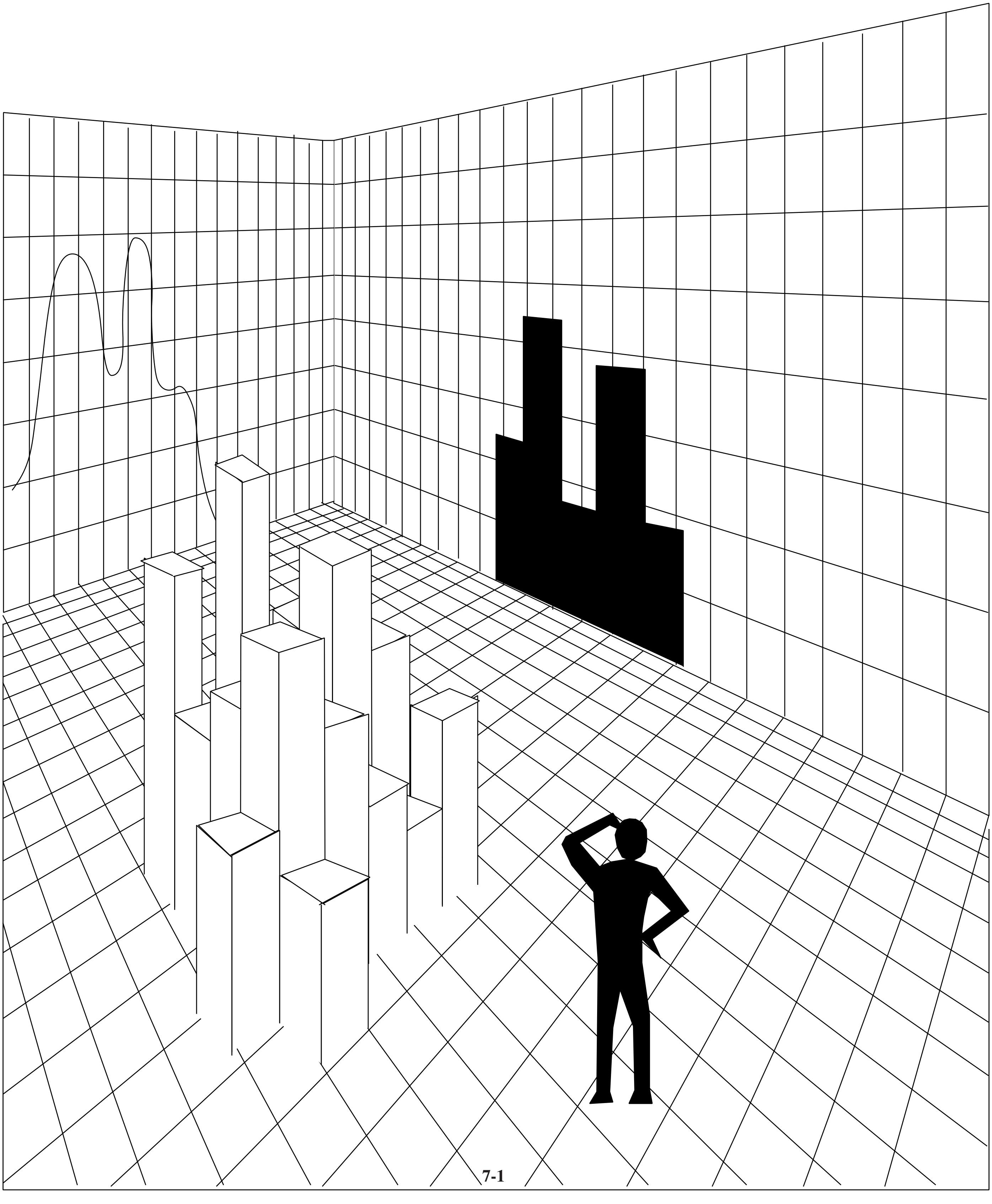
When to Use Photographs and Drawings

Some people imagine that photographs are the best choice for illustrating any situation. The research does not bear that out. On this page we present what your best choices are following the research that has been done on the topic.

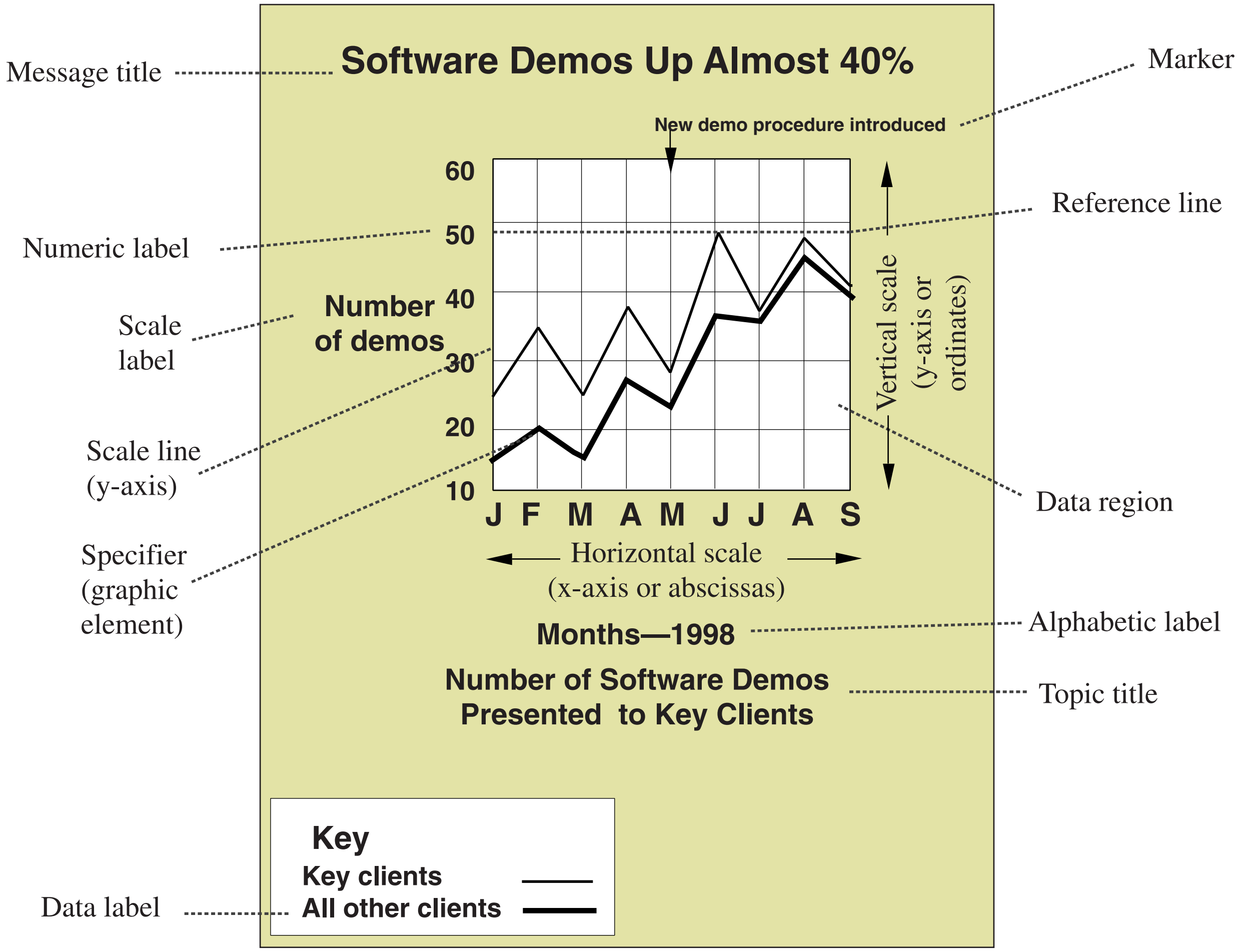
IF you want to show . . .	THEN use . . .
• exact resemblance • parts in exact and detailed locations • small details • textures • that the object (product) actually exists	**photographs** 
• imagined objects, scenes, or events that may not exist or have not happened • objects difficult to illuminate for photographs • selective detail or parts of objects • approximate resemblance or outline when it is sufficient for recognition • object, when too much detail would only confuse learner	**drawings/illustrations** 

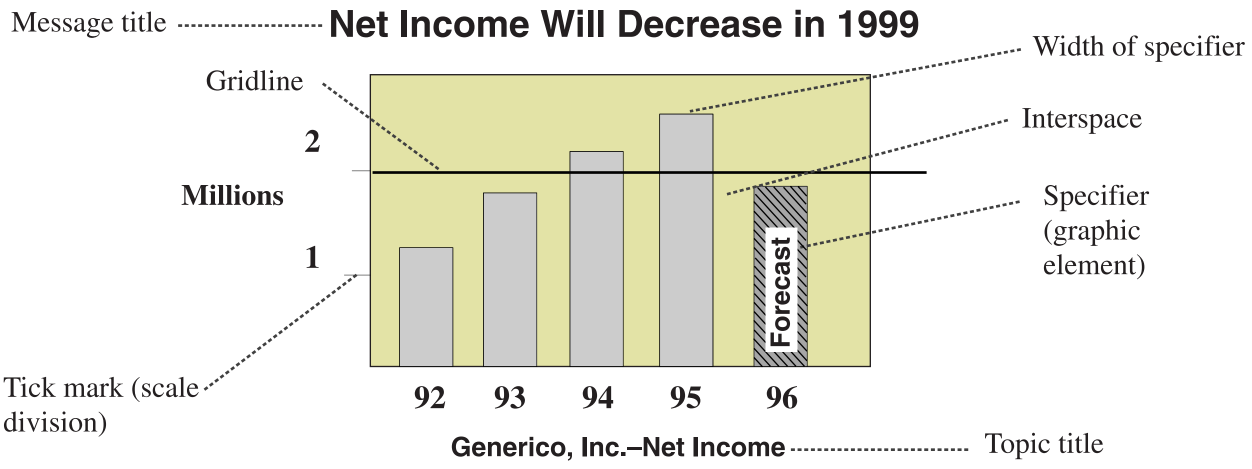
Chapter 7

Quantatative Graphs and Charts



Nomenclature





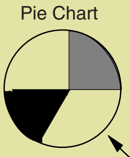
Types of Simple Charts

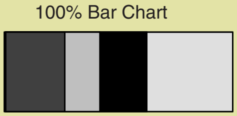
Pie chart & 100% bar chart

(percentage of total)

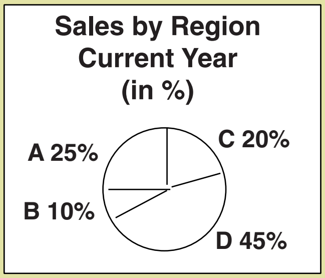
Examples

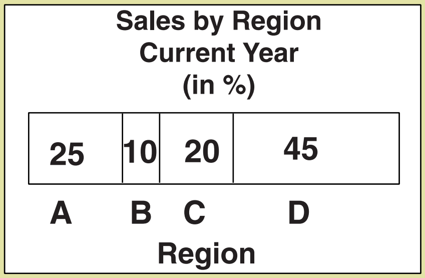
Slices show percent of total





Total area of pie or bar is 100%



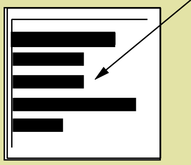


Bar chart

(rank of items)

Note: Items are things like
- departments
- people
- organizations
- geographical regions

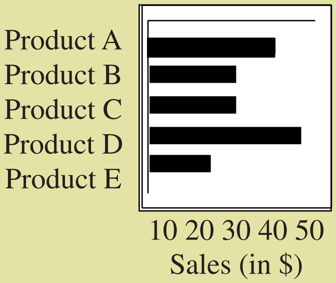
Items go along the vertical



Bars show how many of each item

Amounts go along the horizontal

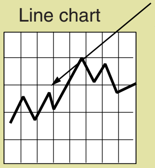
Example



Line and column charts

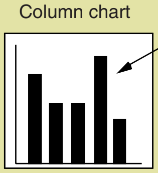
(time series)

Amount of unit measured on vertical



Points on the line show how much at each time

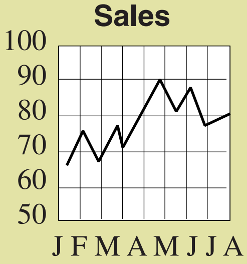
Amount of unit measured on vertical



Columns show how much at each time

Time units are placed along the horizontal

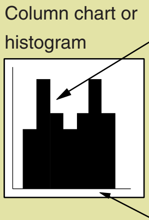
Example



Histograms and histographs

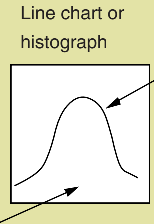
(frequency distributions)

Amount of unit measured on vertical



Columns show how much at each range

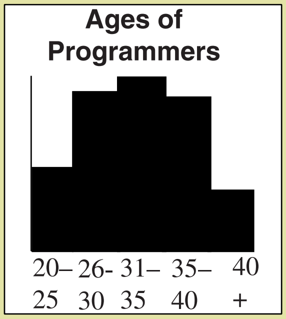
Amount of unit measured on vertical



Points on the line show how much of each range

Ranges of data in each group placed on the horizontal

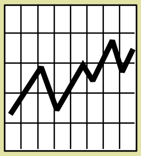
Example



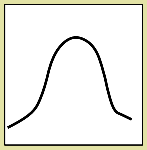
What Chart to Use for Which Audience?

Little or no prior learning required

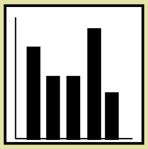
Line chart



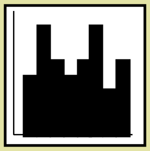
Histograph



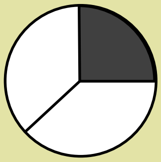
Column chart



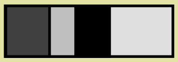
Histogram



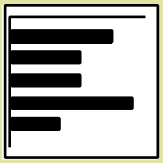
Pie chart



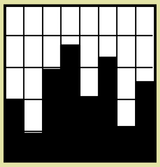
100% bar chart



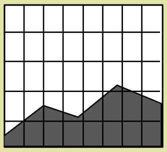
Bar chart



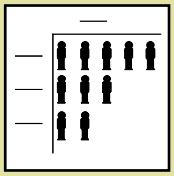
Filled-area graphs



Filled-area graphs



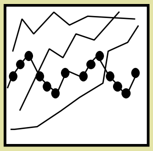
Pictograph bar chart



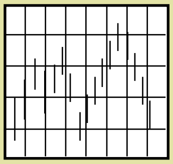
Note: These recommendations are for communication to general business audiences. Groups of specialists may use a particular type of graph so often that they require no explanation for ordinary communication. These recommendations do not apply to the analysis phase.

Some explanation required depending on audience familiarity in subject matter or type of chart

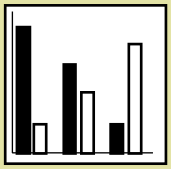
Multiple line graph



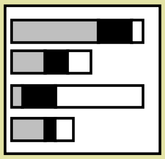
High-low chart



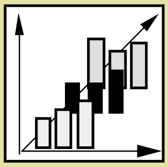
Paired column chart



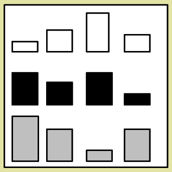
Divided grouped bar chart



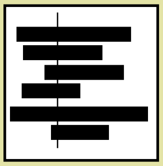
3-D column chart



Divided/grouped column chart

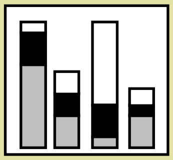


Deviation bar chart

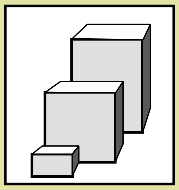


Two-directional bar chart

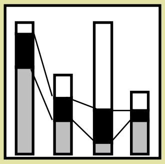
Divided/grouped column chart



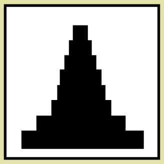
Volume chart



Divided/grouped column chart (stacked and connected)

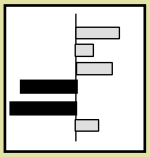


Population pyramid

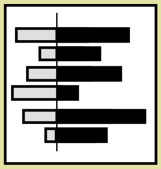


Understanding of charting theory and statistics required

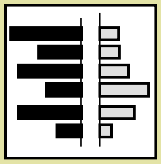
Deviation bar chart



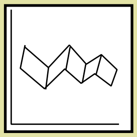
Sliding bar chart



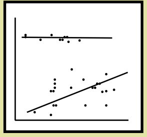
Paired bar chart



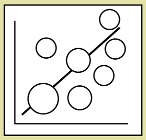
3-D volume line chart



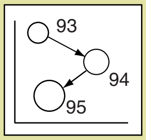
Grouped scattergraph



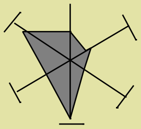
Bubble chart



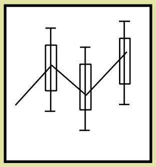
Time dot chart



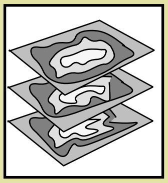
Polar chart



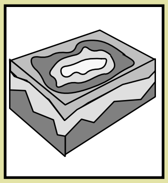
Line graph



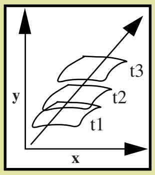
GIS



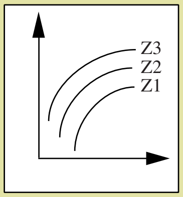
3-D volume representation



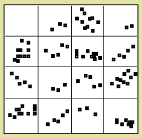
Topographic chart



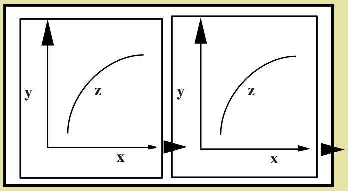
Topographic chart



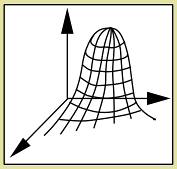
Grouped scattergraph
Scatterplot matrix



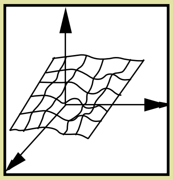
Linear array of line graphs



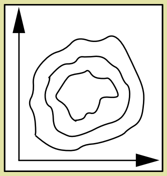
Surface plot



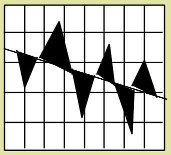
Surface plot



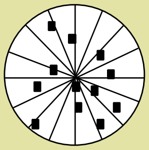
Contour chart



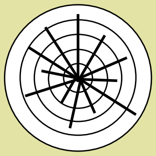
Deviation area graph



Polar chart



Radial bar chart



Choosing Charts for Communication

What are you comparing?

1. Compare components

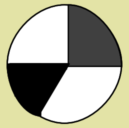
Purpose: Show percent of total

Are you comparing the percentage of one total?

Yes

Is the number of components fewer than 6?

Yes — Use


Pie chart

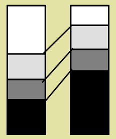
No

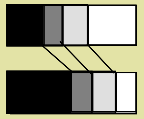
Use five largest components and create an “other” category. Use pie chart.

No

. . . comparing percentage of two or more totals?

Yes — Use


100 % column chart


100 % bar chart

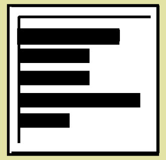
2. Compare items

Purpose: Show rank of items

Items are things like
- departments
- people
- organizations
- geographical

Are you doing simple comparisons of items?

Yes — Use

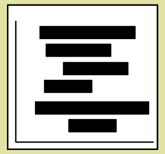

Bar chart

No

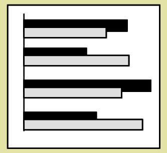
Are you comparing...

. . . spread between high and low amounts

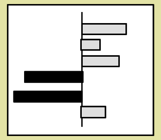
Use


Range bar chart

. . . various aspects of same

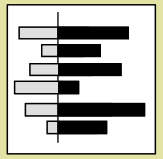

Grouped bar chart

. . . pluses from minuses . . .

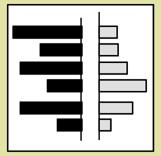

Deviation bar chart

. . . two percentages or other mix...

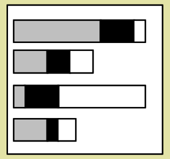
Use


Sliding bar chart

. . . correlation between two items . . .


Paired bar chart

. . . components making up total . . .


Subdivided bar chart

Go to next page

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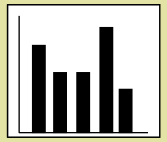
3. Compare changes over time

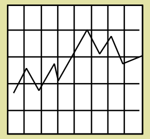
Purpose: Show time series

Are you comparing the number of items over time?

Yes — Use


Column chart

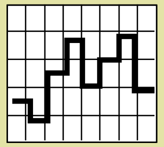
or


Line chart

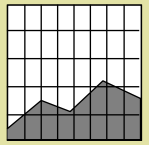
No

Are you comparing . . .

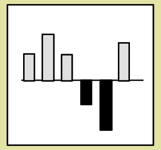
. . . data that change abruptly and irregular


Stepped column chart

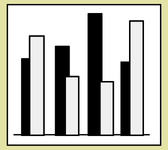
or


Filled-area graphs

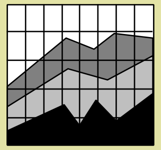
. . . difference between pluses and minuses . . .


Deviation column chart

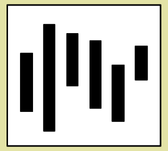
. . . two different items at a point in time . . .


Grouped column chart

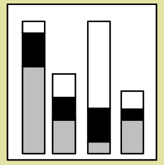
or


Filled-area graphs

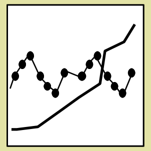
. . . the range of amounts from high to low . . .


Range column chart

. . . the contribution of components to total over time .


Subdivided column chart

or

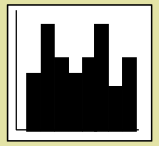

Line graph

4. Compare items within ranges

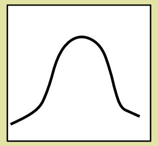
Purpose: Show frequency distribution

Are you comparing the number of items that fall into a series of ranges?

Yes — Use


Histogram

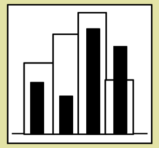
or


Histograph

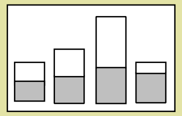
No

Are you comparing two sets of frequencies?

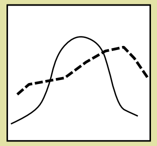
Yes — Use


Grouped column chart

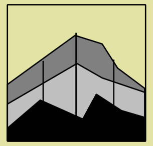
or


Subdivided column chart

or


Grouped line chart

or

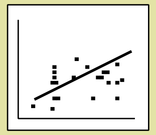

Subdivided surface chart

5. Compare expected pattern with actual pattern

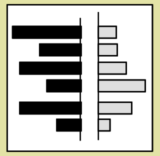
Purpose: Show correlation

Are you comparing the patterns of relationships between two or more variables?

Yes — Use


Scatter Graph

or

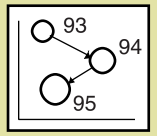

Paired Bar Chart

No

Are you comparing . . .

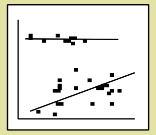
Yes

. . . change over time of the relationship . . .

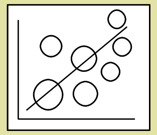


Time dot chart

. . . two items at one time or of one item at two different

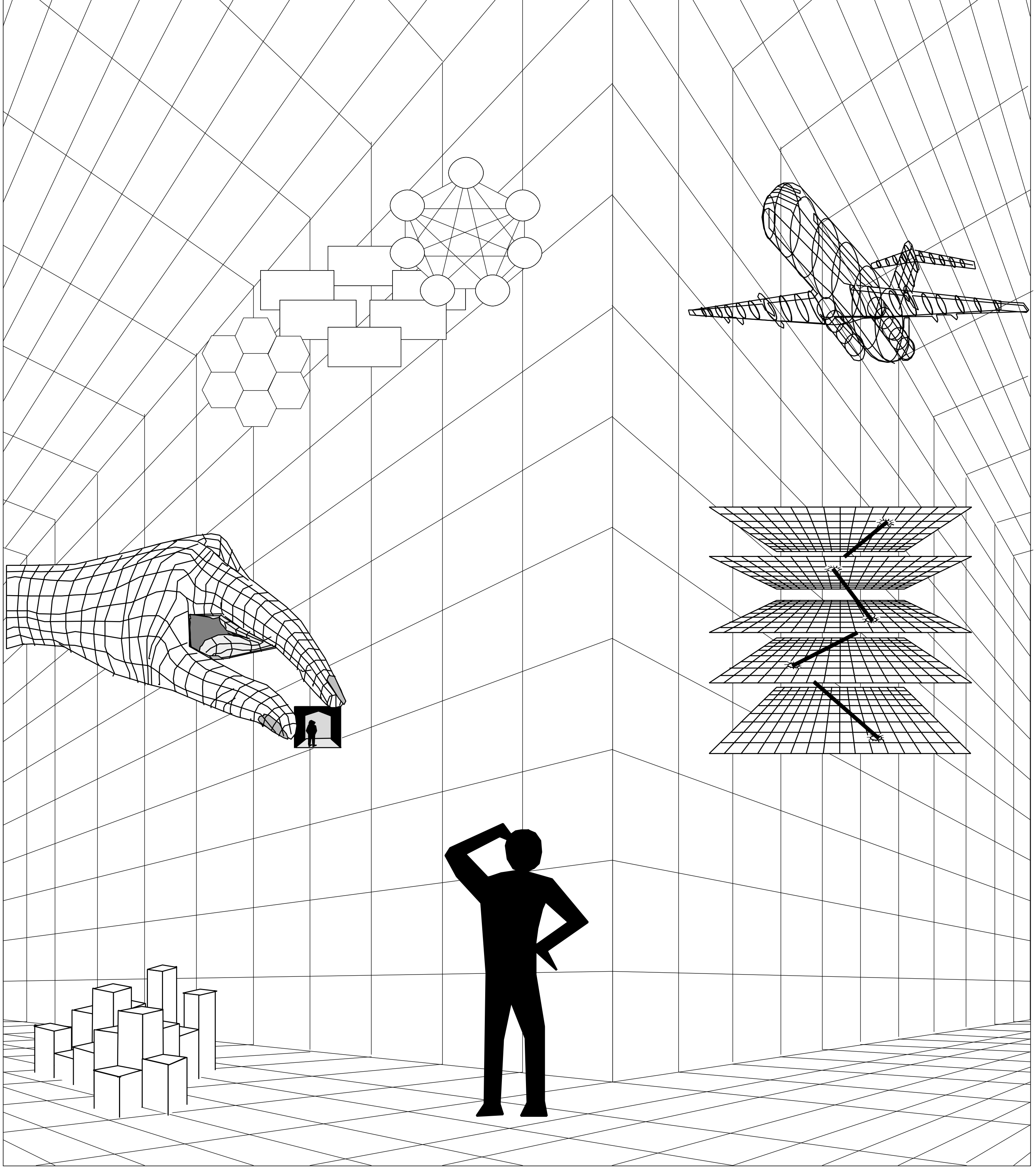

Grouped scatter graph

. . . two items at a time with a third dimension shown by area of bubble . .


Bubble chart

Chapter 8

MacroVU™ Communication Units



F Explanatory Material Appears in the Body of the Text

Parts of the Eye and Their Functions

The eyeball has three main groupings: 1) the outer layer, 2) the middle layer, and 3) the inner layer.

In the outer layer are the cornea and extrinsic muscles. The transparent cornea allows passage of light rays through the eye. The extrinsic muscles permit and limit movements of the eyeball within the orbit of the eye.

Next comes the middle layer. There is a circular opening in front, the pupil, which allows light to enter. There is a colored muscular ring surrounding the pupil called the iris. It controls the size of pupil and amount of light entering the eye. Next to the pupil is the ciliary muscle, which contracts and moves the lens. Aqueous humor, which fills the area between the cornea and the lens, is produced by the ciliary body. The suspensory ligament suspends the lens and relaxes to allow curvature of the inner lens. Finally, the crystalline lens brings light rays to focus on the light-sensitive area.

The innermost layer contains the lining at the back of the eye, which is called the retina. It is highly specialized, in order to convert light energy into nerve impulses. The optic nerve conveys impulses to visual centers in the occipital (posterior) part of the brain.

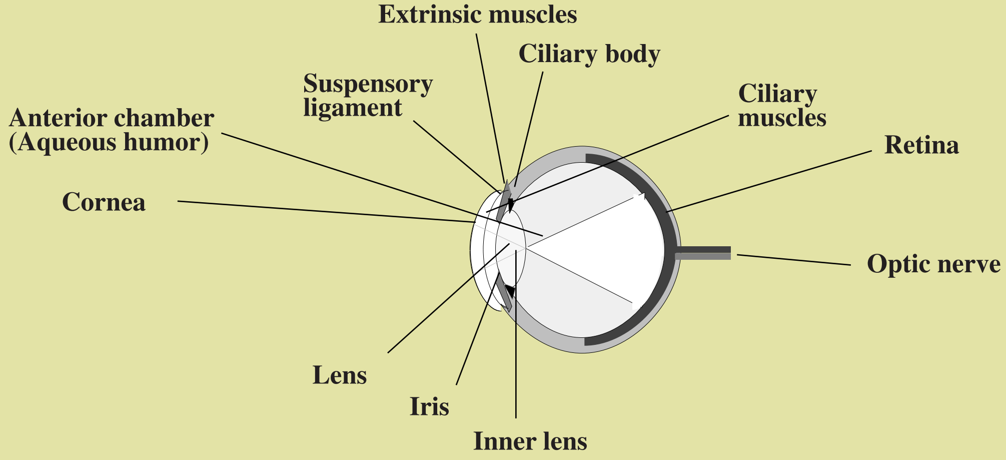


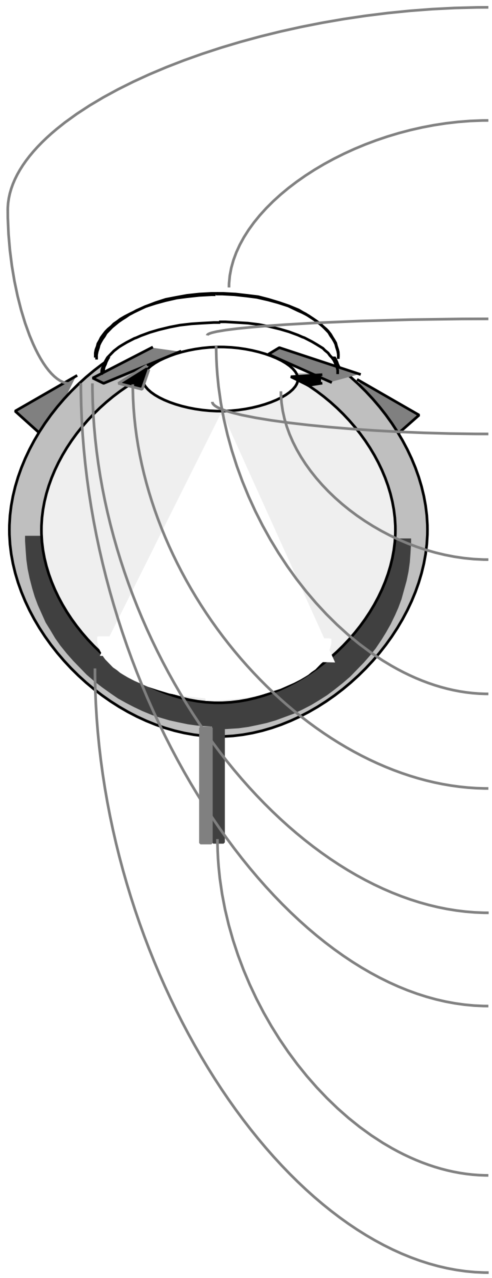
Figure 1. The Eye

From *Physiology of the Eye: A Review for Pharmaceutical Sales Persons*

G

Drawing and Text Combine in Table

Parts of the Eye and Their Functions



Parts / Function of Parts

The eyeball has three main groupings:

1. Outer layer

Extrinsic muscles
permit and limit movements of eye ball within orbit

Cornea
allows passage of light rays

2. Middle layer

Aqueous humor
fills area between cornea and lens

Lens
brings light rays to focus on light-sensitive area

Iris
controls size of pupil and amount of light entering the eye.

Pupil
allows light to enter

Suspensory ligament
suspends the lens and relaxes to allow curvature of lens

Ciliary body
produces aqueous humor

Ciliary muscle
contracts and moves lens

3. Inner layer

Optic nerve
conveys impulses to visual centers in occipital (posterior) part of brain

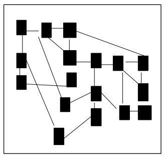
Retina
is highly specialized to convert light energy into nerve impulses

From *Physiology of the Eye: A Review for Pharmaceutical Sales Persons*

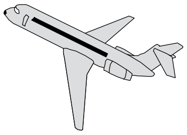
Definition and Central Visual Element Principle

Any of the following ....

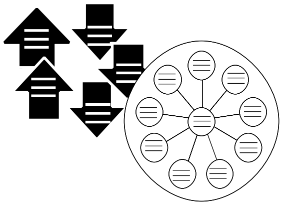
Diagrams



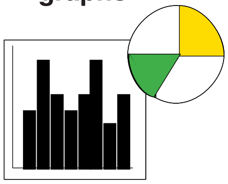
Resemblances



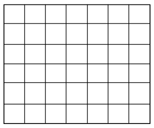
Cluster diagrams



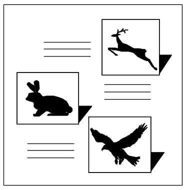
Quantitative charts and graphs



Tables, matrices



Group of VLicons

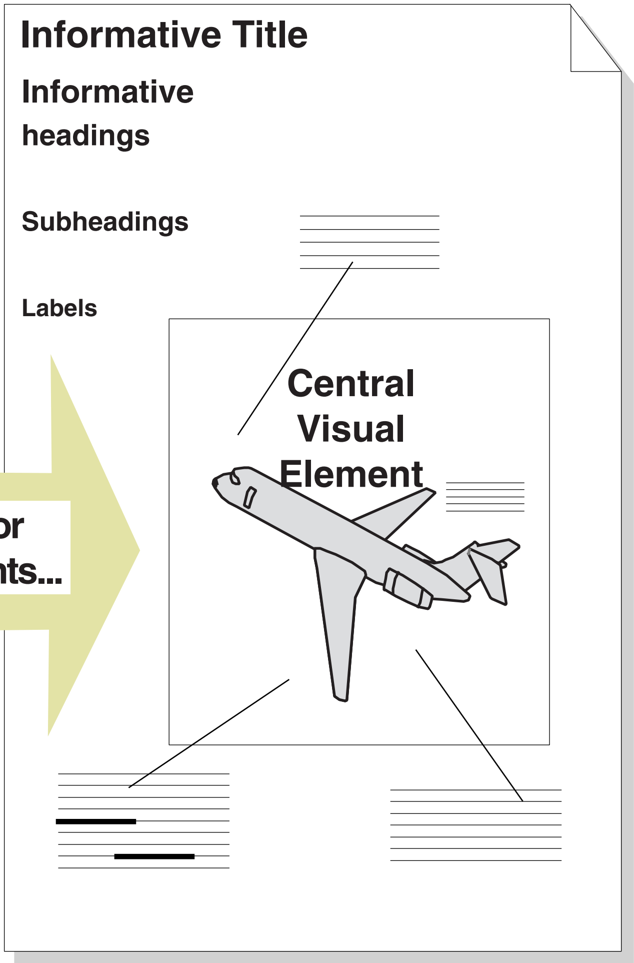


... are often used for central visual elements...

Central Visual Element(s) Principle

For each MacroVU Communication Unit, provide (if possible) a central visual element or, if required, several visual elements.

MacroVU™ Communication Unit



MacroVU Communication Unit

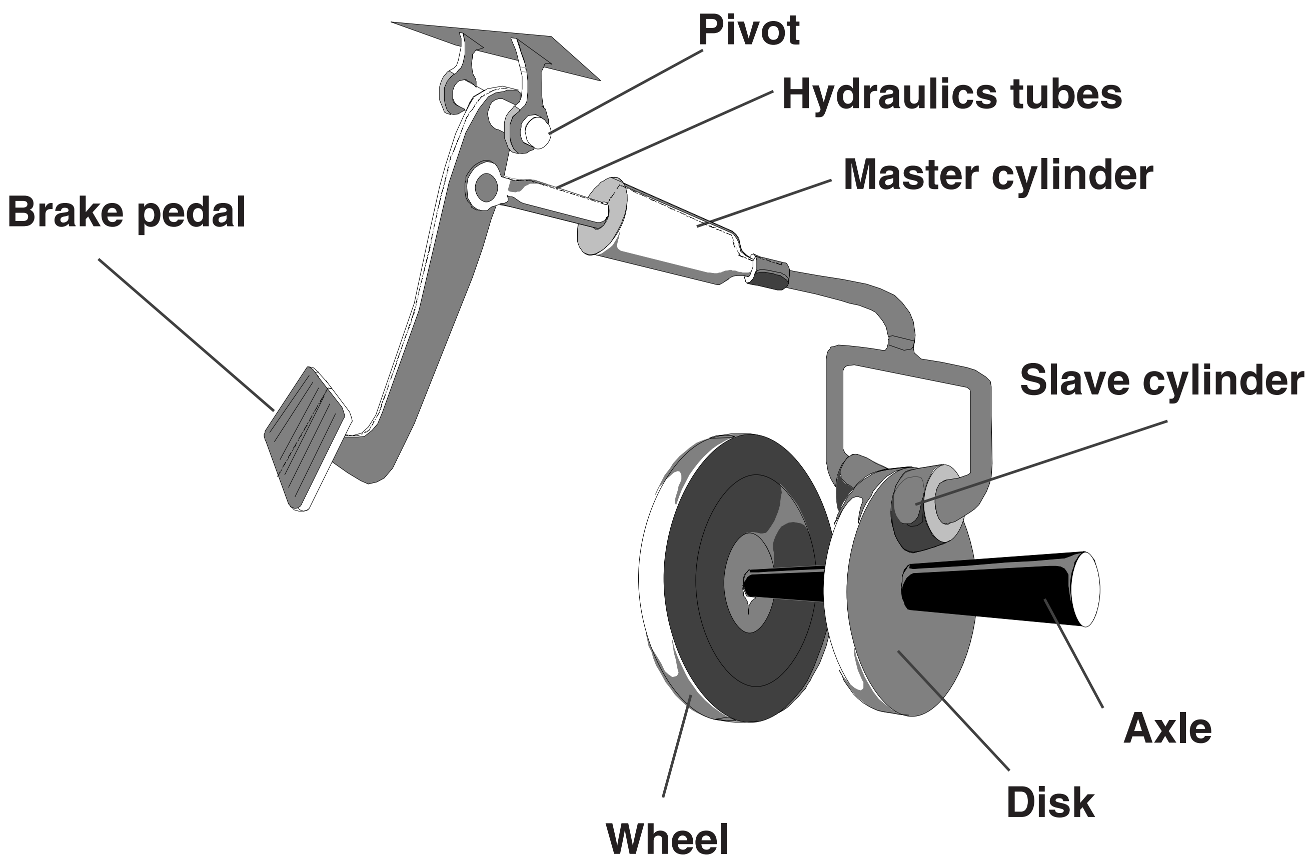
Definition. Moderately sized, meaningful combinations of words, images, and shapes constituting a complete communication unit. Their visual and verbal elements are tightly integrated. MacroVU Communication Units are as self-contained as possible on one or two pagesor a large screen. Usually contain central visual element(s) and one or more blocks of text.
Syn. information graphic, infographic (in newspaper and magazine graphics).

Example of a MacroVU™ Communication Unit

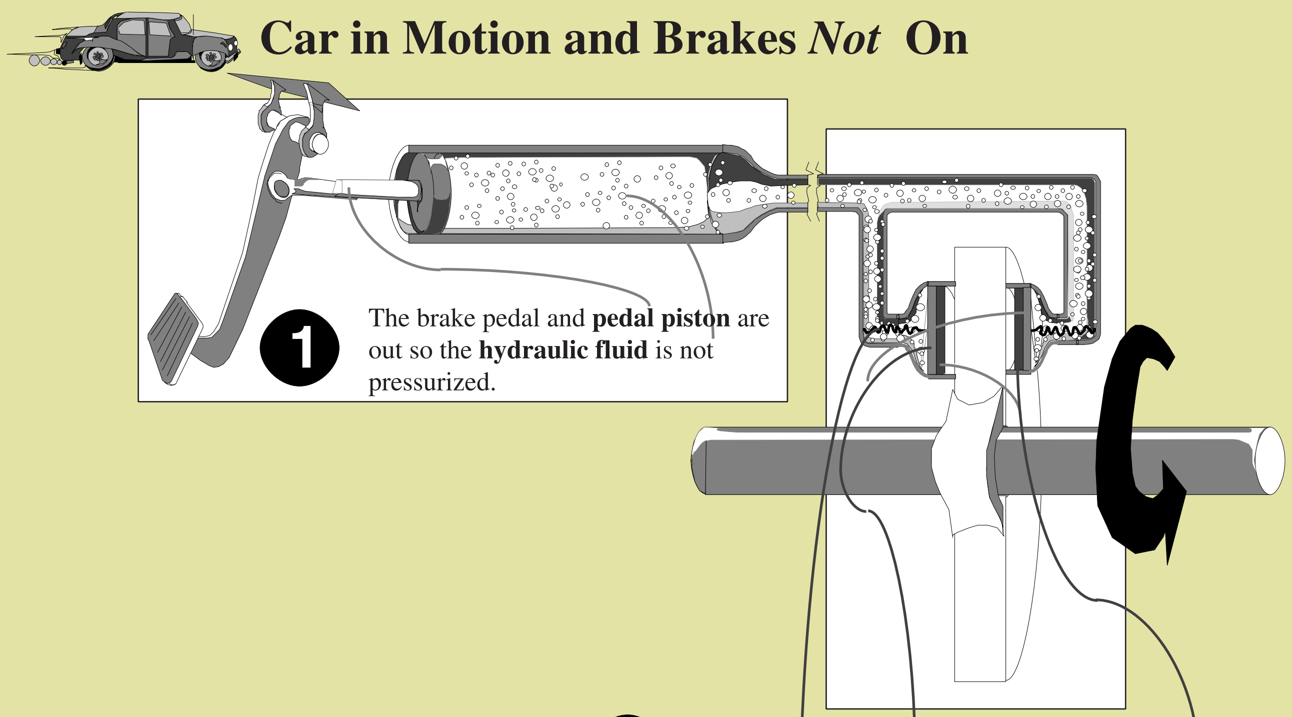
How a Disk Brake Works

Here we examine a disk brake system in a car in order to glean a general understanding of disk brakes. The 3-D perspectives show the spatial relationship of the parts of the system, whereas the lower diagrams show how these parts function before and after the brakes are applied.

Definition. A hydraulic mechanism that uses friction to slow down a spinning disk.



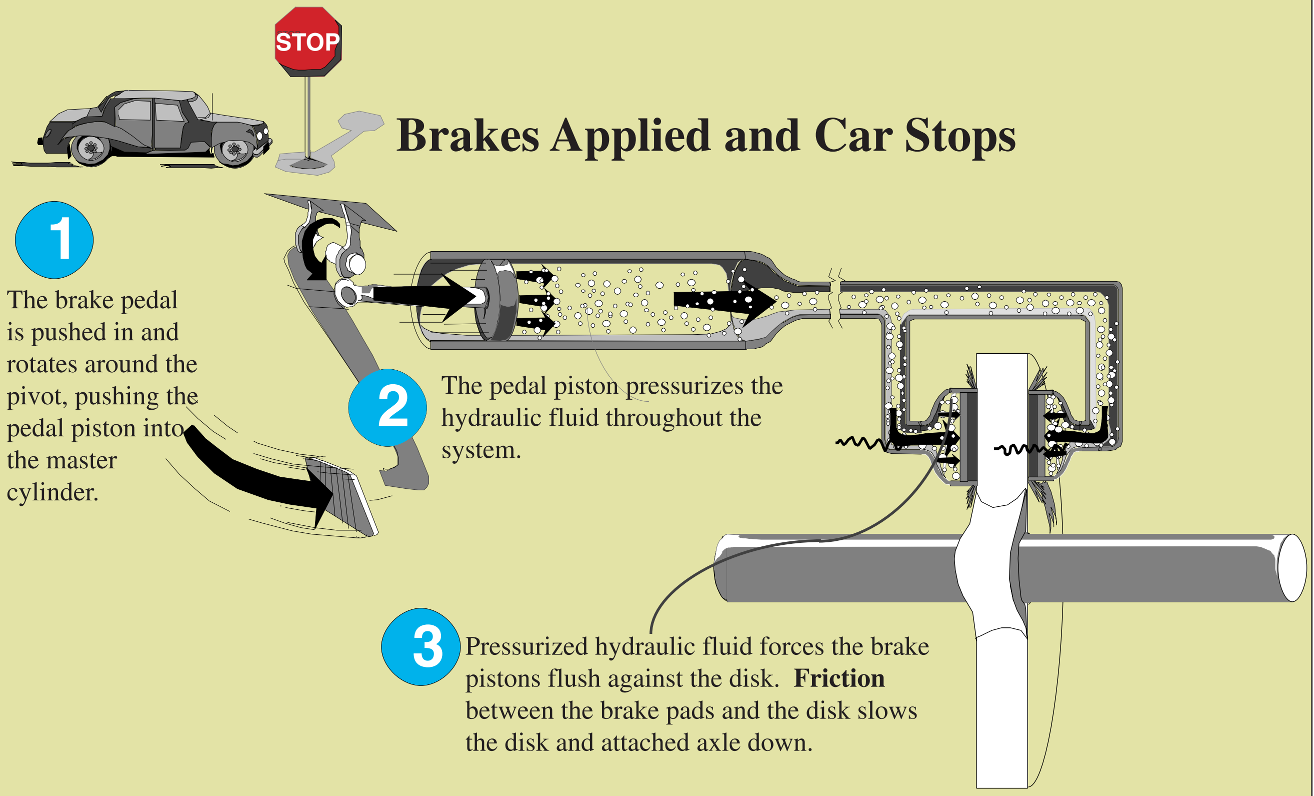
Car in Motion and Brakes *Not* On



1 The brake pedal and **pedal piston** are out so the **hydraulic fluid** is not pressurized.

2 Because the hydraulic fluid places no pressure on the **brake pistons**, the **brake pads** are easily held away from the disk by the **pulling springs**, allowing the disk and the attached axle to turn freely.

Brakes Applied and Car Stops



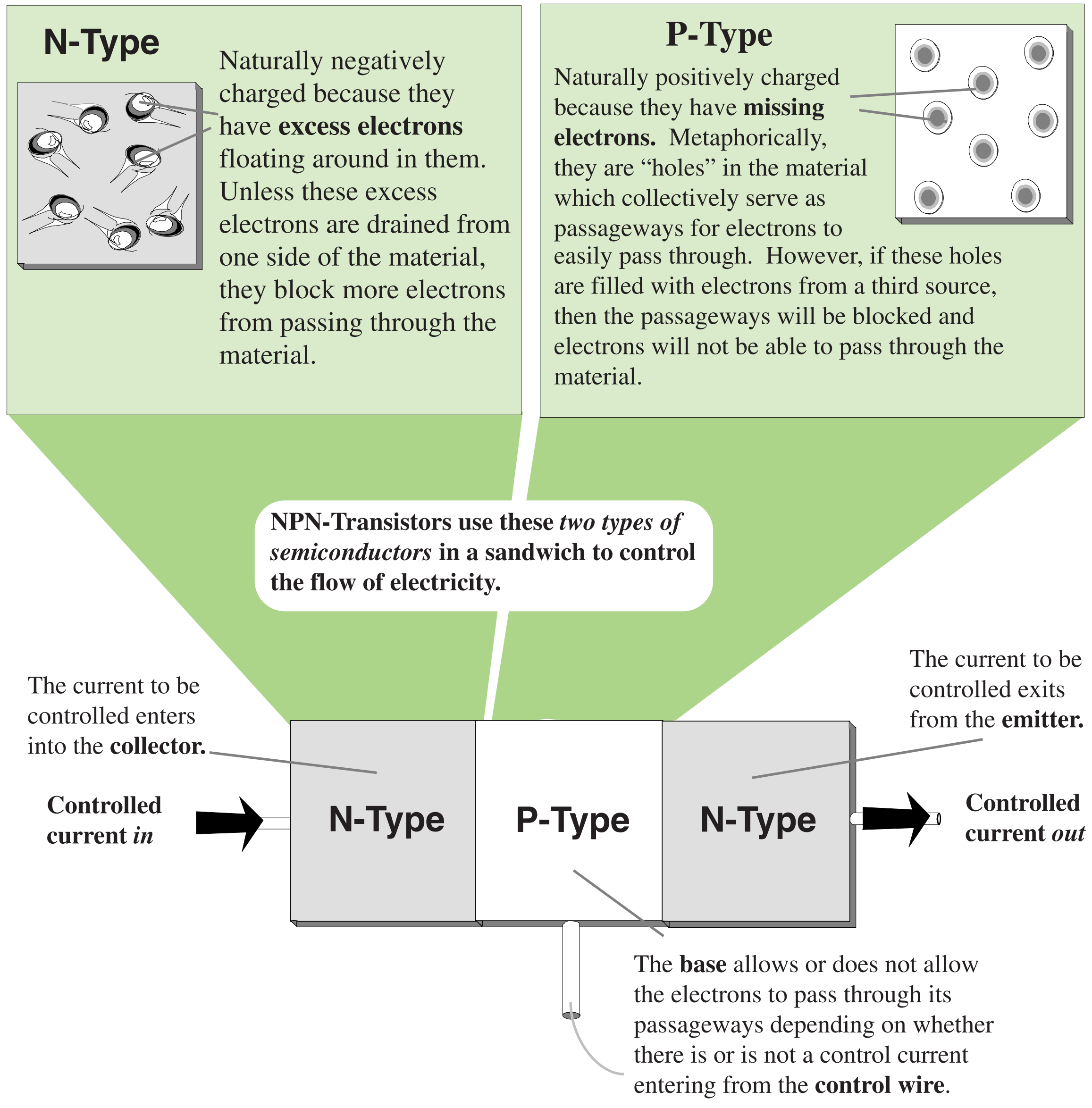
1 The brake pedal is pushed in and rotates around the pivot, pushing the pedal piston into the master cylinder.

2 The pedal piston pressurizes the hydraulic fluid throughout the system.

3 Pressurized hydraulic fluid forces the brake pistons flush against the disk. **Friction** between the brake pads and the disk slows the disk and attached axle down.

How a Transistor Works

Definition. A **transistor** is an electronic device that allows electricity through it in some circumstances and not in others. Usually, this is determined by whether or not there is a control current going into the transistor from a third wire.



N-Type

Naturally negatively charged because they have **excess electrons** floating around in them. Unless these excess electrons are drained from one side of the material, they block more electrons from passing through the material.

P-Type

Naturally positively charged because they have **missing electrons.** Metaphorically, they are “holes” in the material which collectively serve as passageways for electrons to easily pass through. However, if these holes are filled with electrons from a third source, then the passageways will be blocked and electrons will not be able to pass through the material.

NPN-Transistors use these *two types of semiconductors* in a sandwich to control the flow of electricity.

The current to be controlled enters into the **collector.**

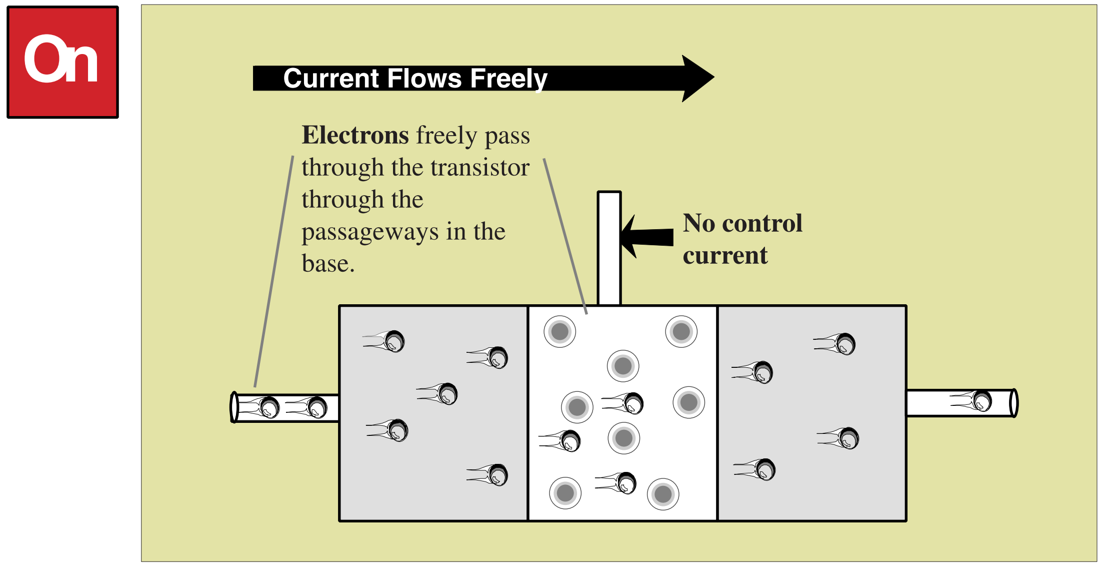
Controlled current *in*

The current to be controlled exits from the **emitter.**

Controlled current *out*

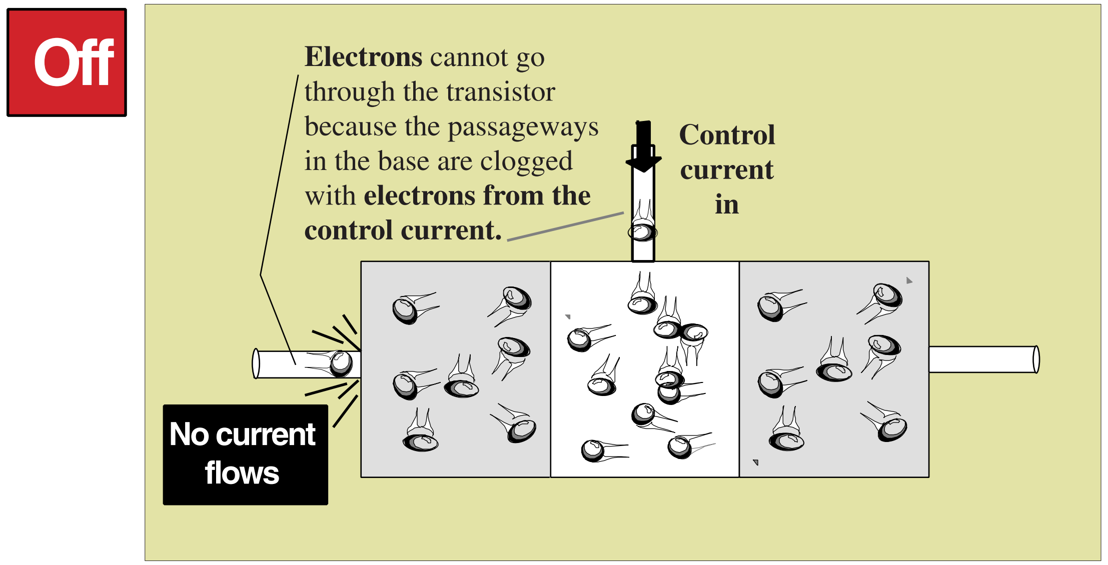
The **base** allows or does not allow the electrons to pass through its passageways depending on whether there is or is not a control current entering from the **control wire**.

The Two States of a Transistor



Electrons freely pass through the transistor through the passageways in the base.

No control current



Electrons cannot go through the transistor because the passageways in the base are clogged with **electrons from the control current.**

Control current in

Note: When a transistor is on, electrons can actually flow across it in either direction. Physically, there is no difference between the collector and the emitter. It is simply a naming convention that the current flows into the “collector” and out of the “emitter.”

Difference Between Documents and Slides and Screens

MacroVU Communication Units can be used in documents, slides, and screens.

Principle of Adapting to Media

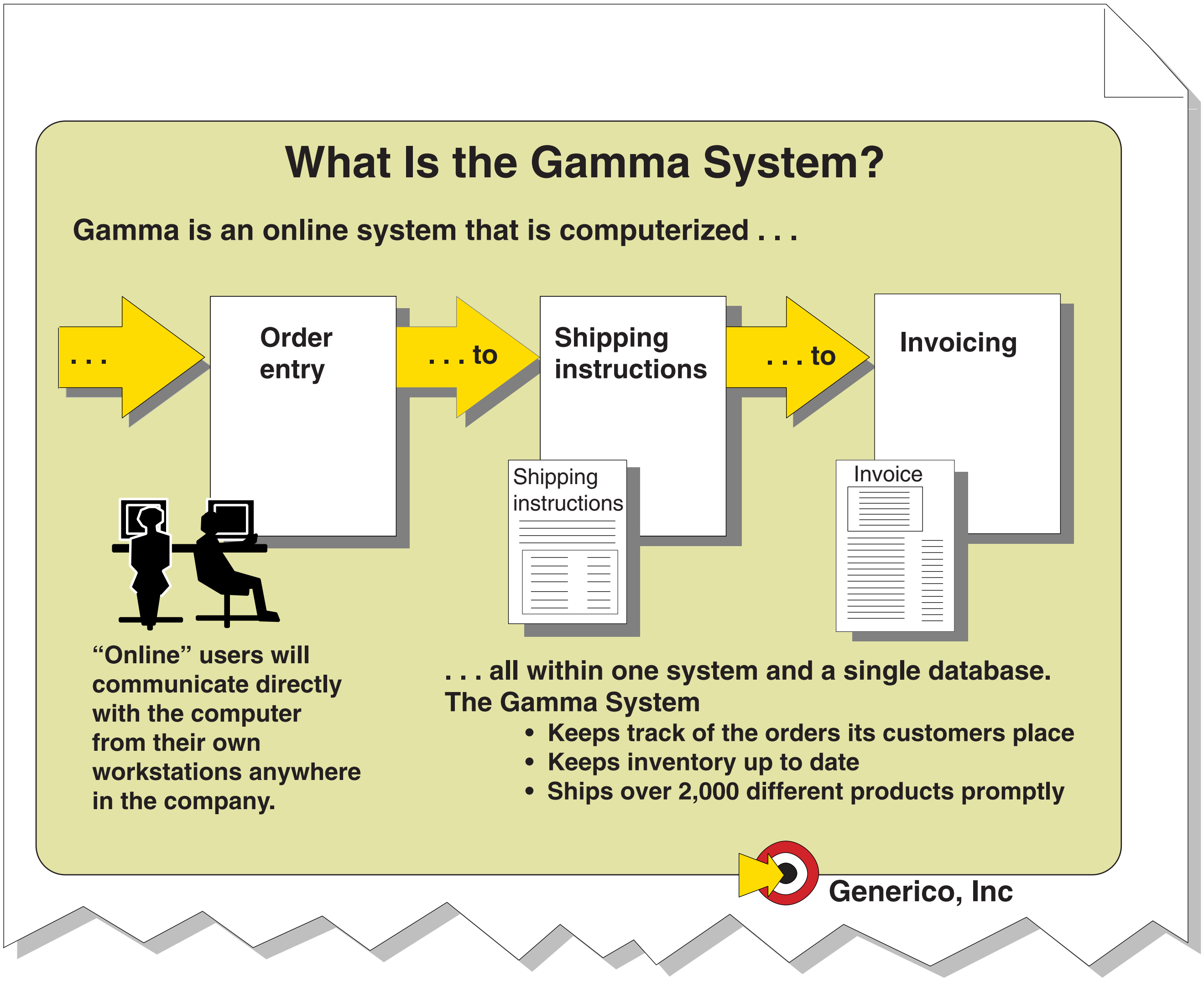
Different media and presentation situations present different requirements for "density" of MacroVU Communication Units. For example, slide versions should display fewer words than printed versions of same material. Fewer words can be used on slides and on most computer screens than on documents.

Documents and computer screens

Below is an example that we have used several times in this course to show a half-page MacroVU CU in a document. It could be used without change on the current average computer screen, although many older screens would not handle the graphics very well.

Slide or overhead transparency

For comparison, the same document is presented on the next page as it might appear on a slide or overhead transparency.



What Is the Gamma System?

Gamma is an online system that is computerized . . .

. . .
Order entry
. . . to
Shipping instructions
Shipping instructions
. . . to
Invoicing
Invoice

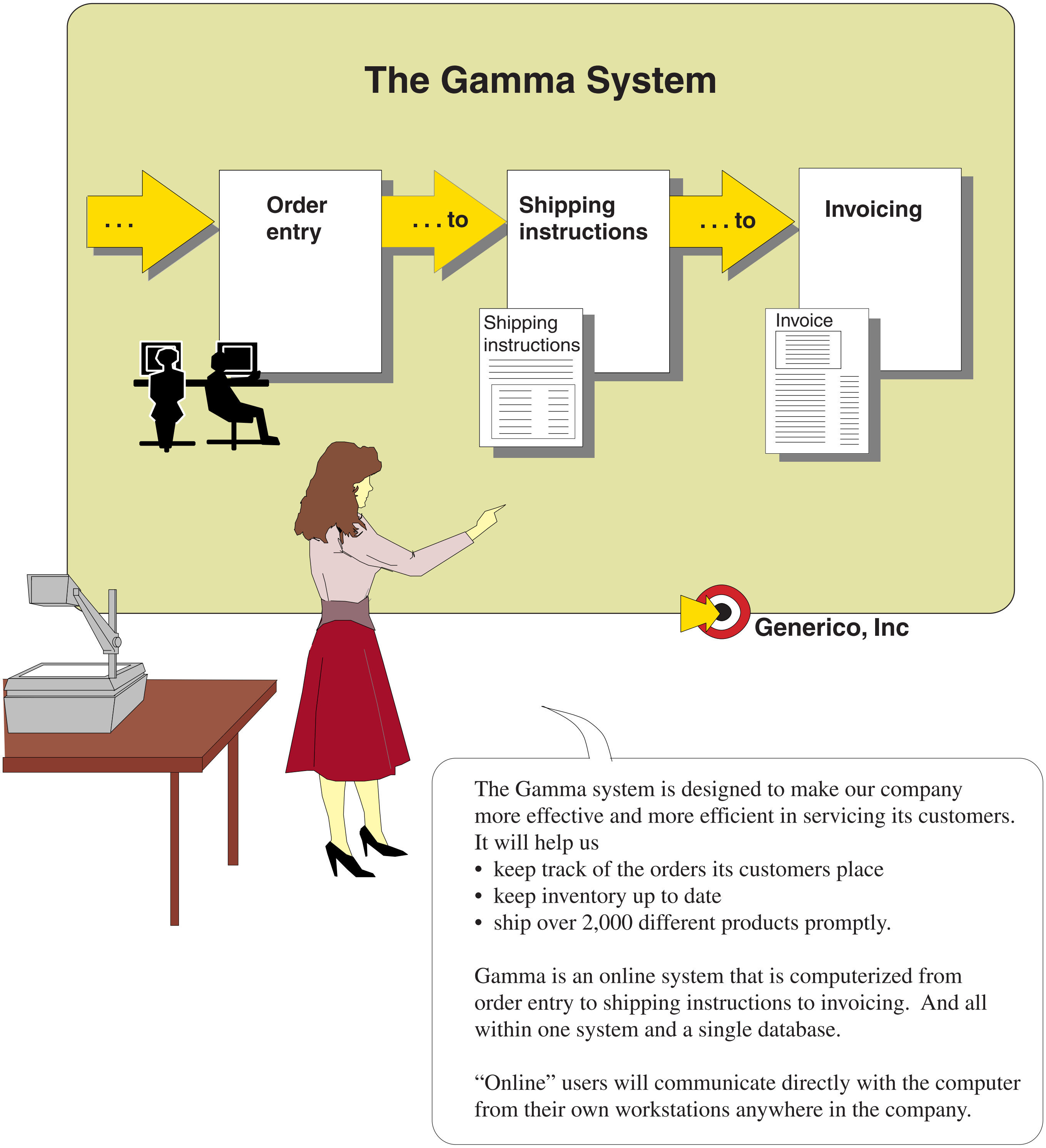
"Online" users will communicate directly with the computer from their own workstations anywhere in the company.

. . . all within one system and a single database.
The Gamma System

- **Keeps track of the orders its customers place**
- **Keeps inventory up to date**
- **Ships over 2,000 different products promptly**

Generico, Inc

Simplified MacroVU Communication Unit for Screen Projection



The Gamma system is designed to make our company more effective and more efficient in servicing its customers. It will help us

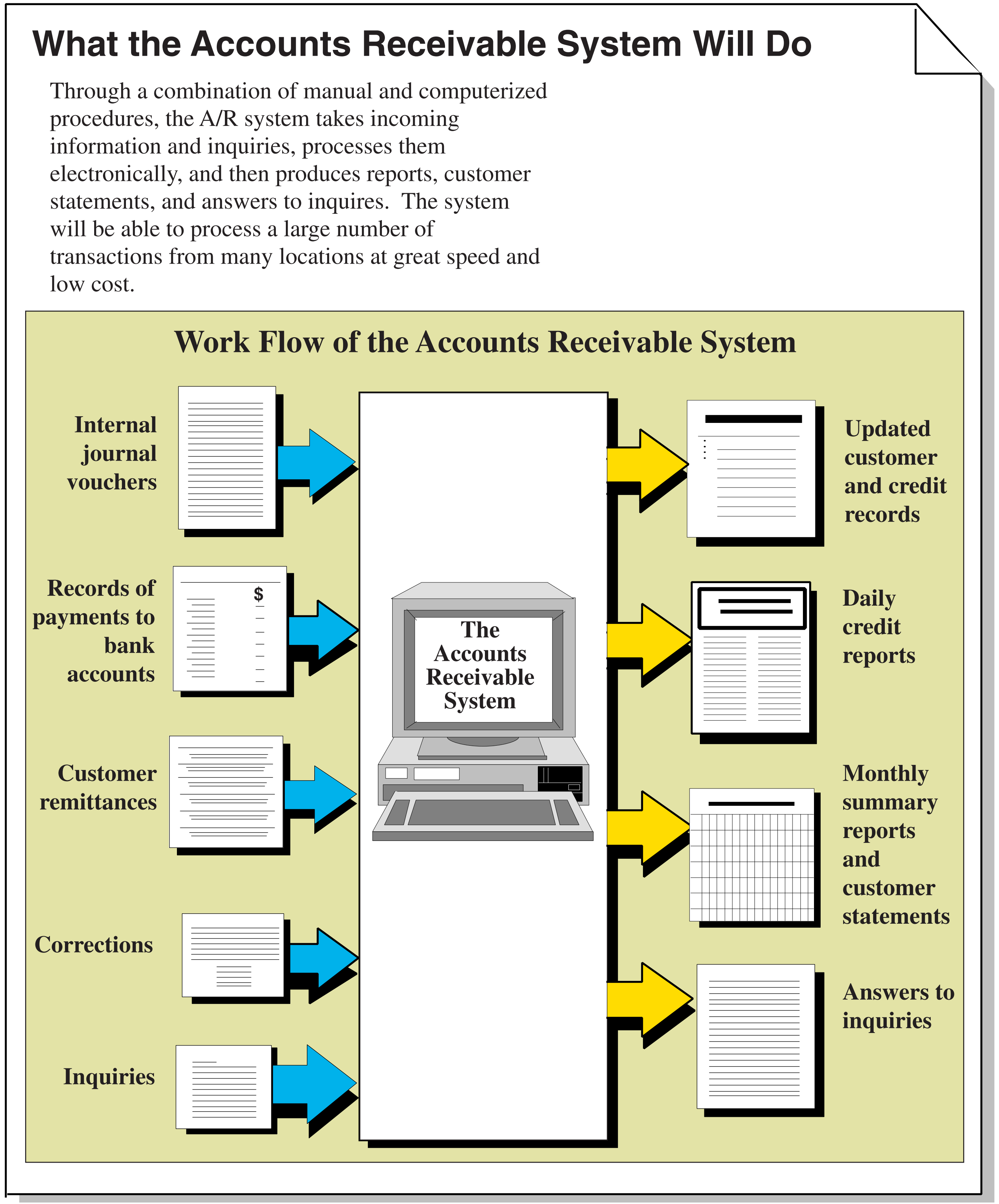
- keep track of the orders its customers place
- keep inventory up to date
- ship over 2,000 different products promptly.

Gamma is an online system that is computerized from order entry to shipping instructions to invoicing. And all within one system and a single database.

“Online” users will communicate directly with the computer from their own workstations anywhere in the company.

Simplify MacroVU CU Visuals for Screen

MacroVU communication units can be somewhat more detailed in documents than on most computer screens. Compare the document below with its translation to screen on the opposite page.

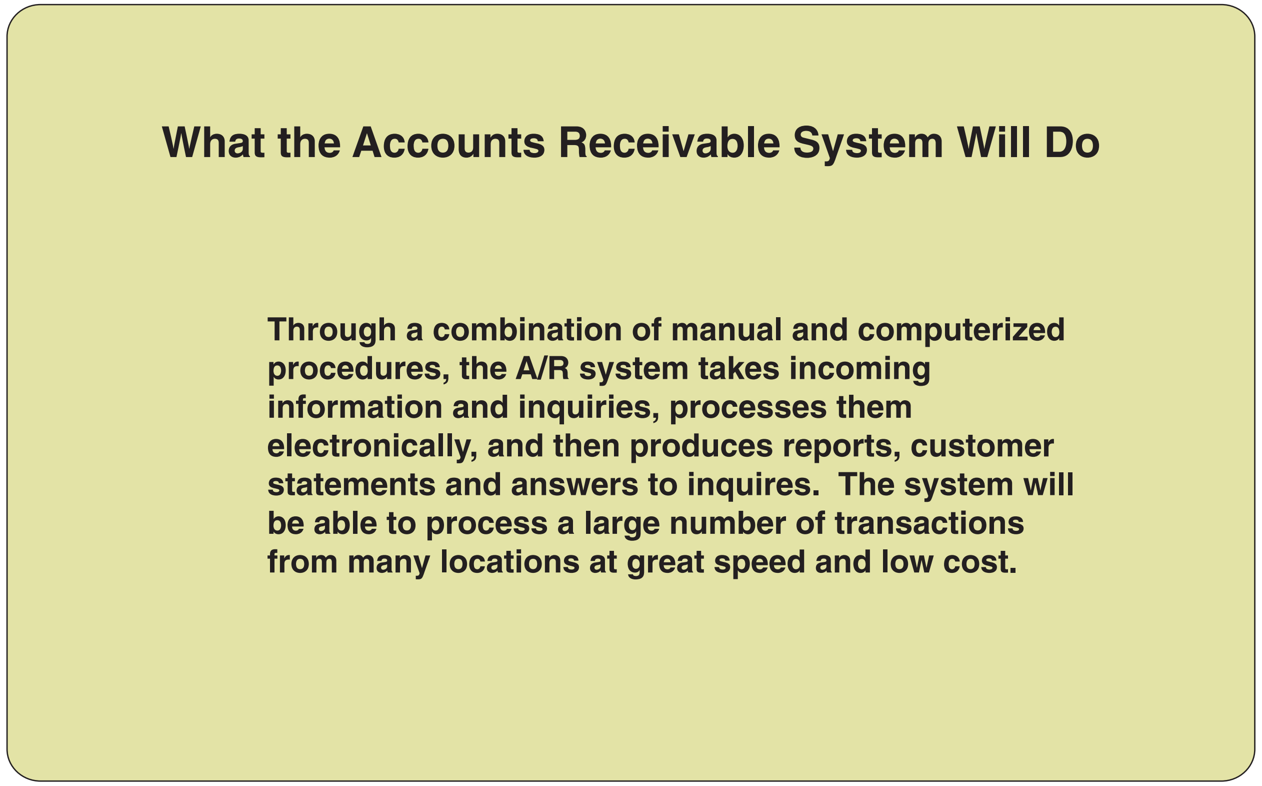


What the Accounts Receivable System Will Do

Through a combination of manual and computerized procedures, the A/R system takes incoming information and inquires, processes them electronically, and then produces reports, customer statements, and answers to inquires. The system will be able to process a large number of transactions from many locations at great speed and low cost.

Work Flow of the Accounts Receivable System

Internal journal vouchers
Records of payments to bank accounts
Customer remittances
Corrections
Inquiries
The Accounts Receivable System
Updated customer and credit records
Daily credit reports
Monthly summary reports and customer statements
Answers to inquiries



What the Accounts Receivable System Will Do

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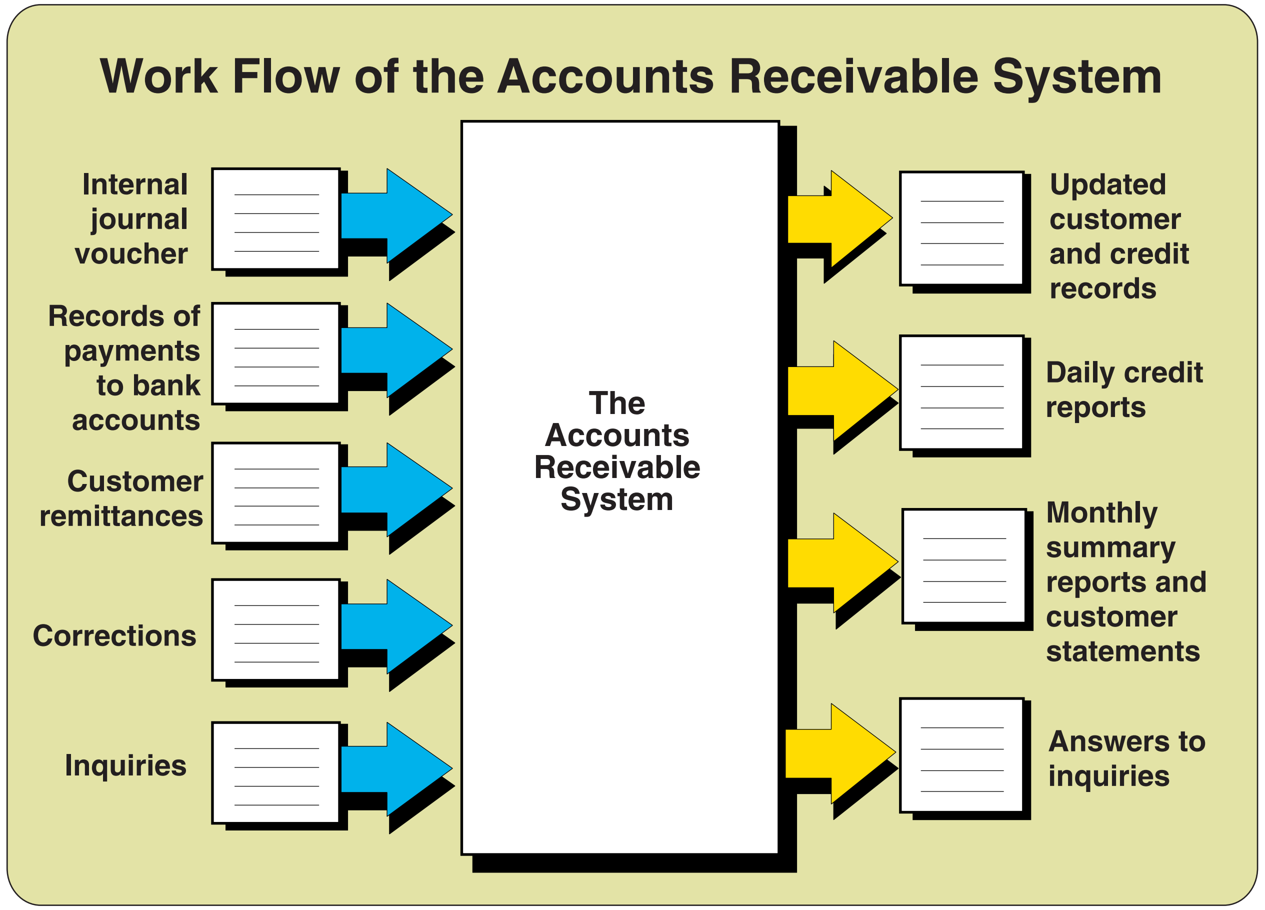


Work Flow of the Accounts Receivable System

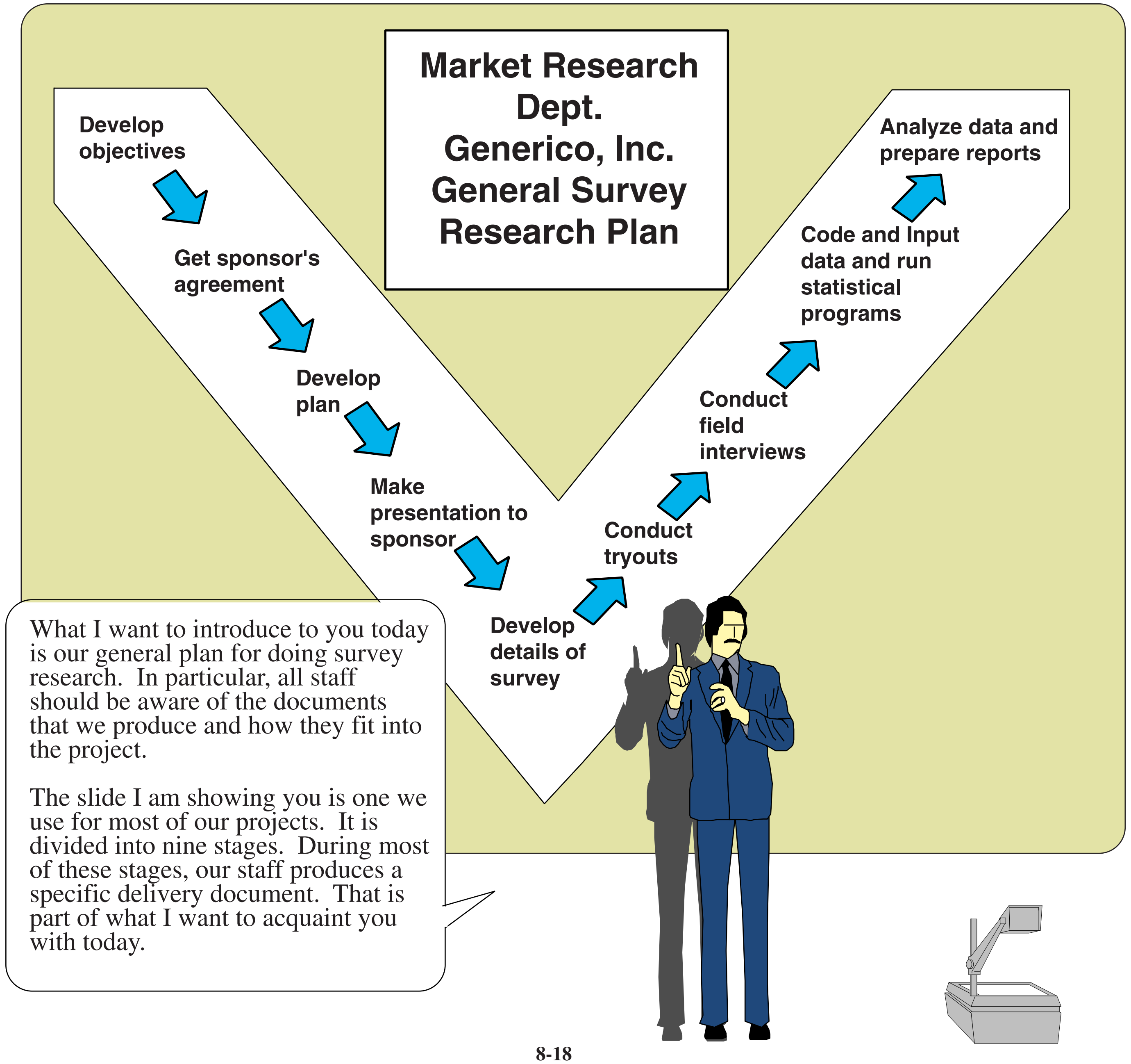
Internal journal voucher
Records of payments to bank accounts
Customer remittances
Corrections
Inquiries
The Accounts Receivable System
Updated customer and credit records
Daily credit reports
Monthly summary reports and customer statements
Answers to inquiries

Build Up Complicated MacroVU Communication Units One Step at a Time

Problem: Overwhelm viewer/reader
Many times MacroVU Communication Units can look overwhelming to initial viewers, particularly if they are not familiar with the subject matter. Yet, not to use MacroVUs would go against the very purpose that many of them have, i.e. to bring together a great deal of information in one place, all organized and integrated.

Solution: Build up one step at a time
One way to solve this problem is to display them one component at a time. On these pages we show how to build up to a fairly complicated MacroVU with a linear flowchart that identifies the major stages of a market research survey project as a central visual element. The point of this presentation is to familiarize the audience with both the project and the documents that the market research organization produces along the way as a product.

On the following pages we present an idea of how one could build up to showing the final project.

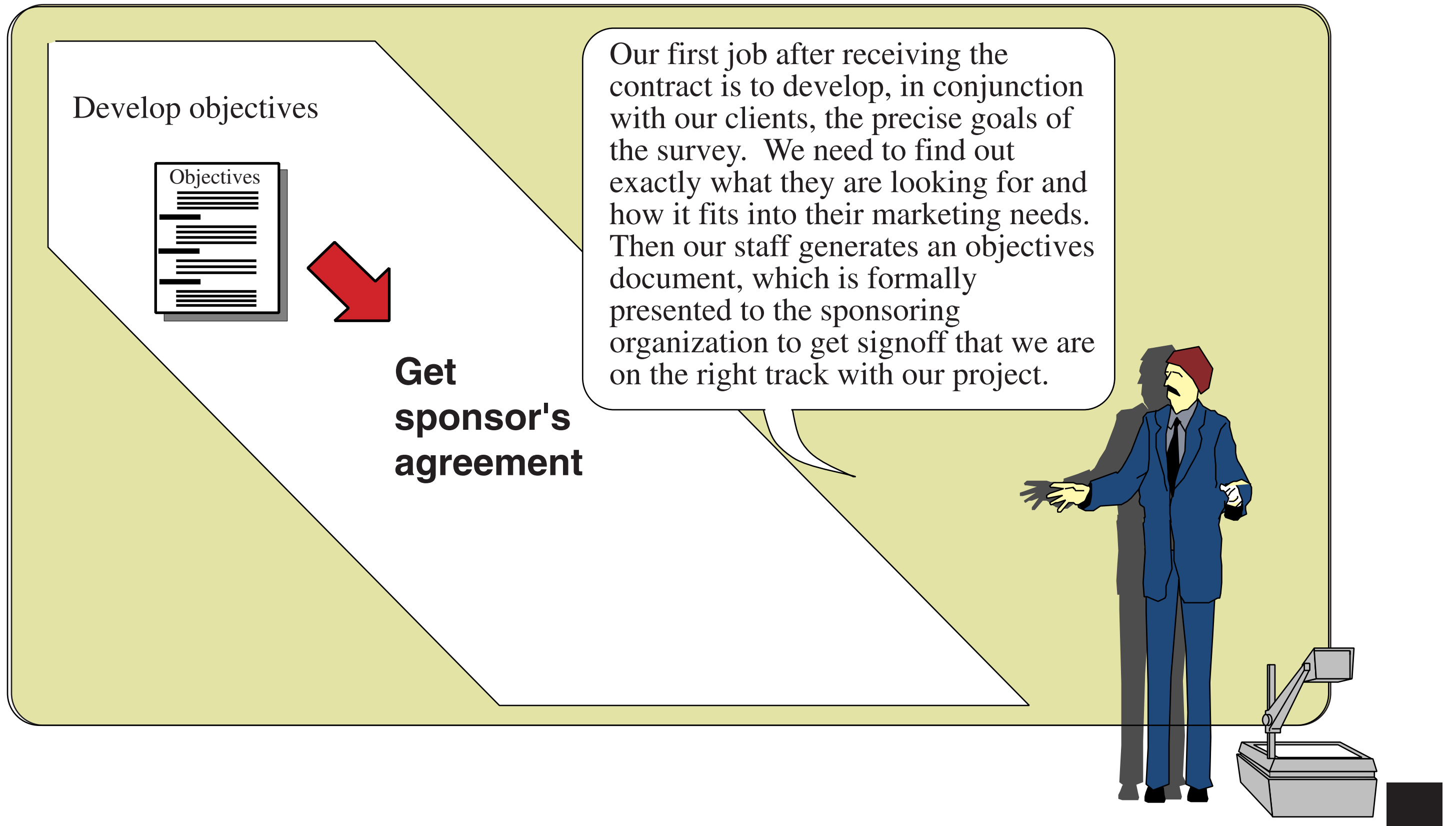


Market Research Dept.
Generico, Inc.
General Survey Research Plan

Develop objectives
Get sponsor's agreement
Develop plan
Make presentation to sponsor
Develop details of survey
Conduct tryouts
Conduct field interviews
Code and Input data and run statistical programs
Analyze data and prepare reports

What I want to introduce to you today is our general plan for doing survey research. In particular, all staff should be aware of the documents that we produce and how they fit into the project.

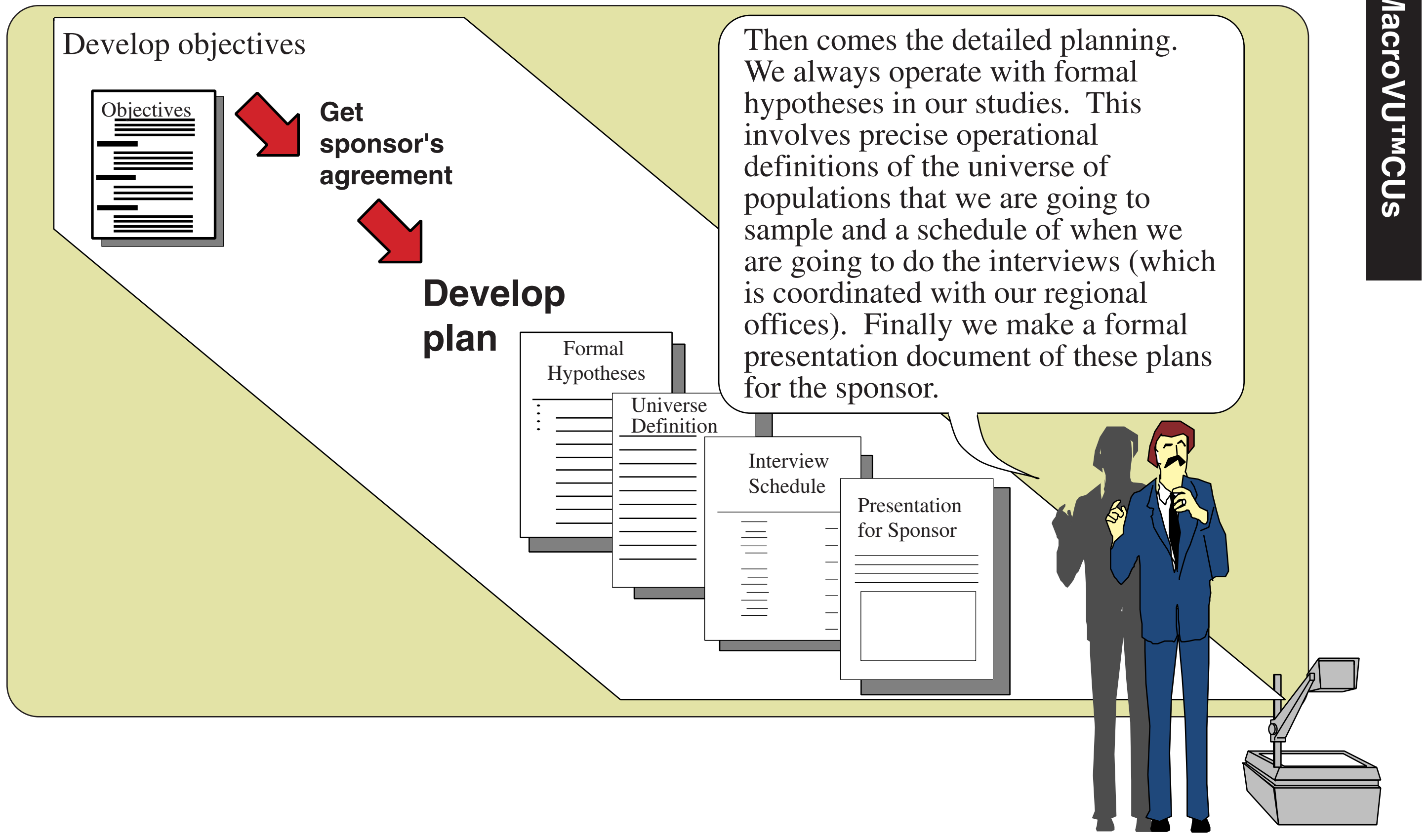
The slide I am showing you is one we use for most of our projects. It is divided into nine stages. During most of these stages, our staff produces a specific delivery document. That is part of what I want to acquaint you with today.



Develop objectives

Get sponsor's agreement

Our first job after receiving the contract is to develop, in conjunction with our clients, the precise goals of the survey. We need to find out exactly what they are looking for and how it fits into their marketing needs. Then our staff generates an objectives document, which is formally presented to the sponsoring organization to get signoff that we are on the right track with our project.



Develop objectives

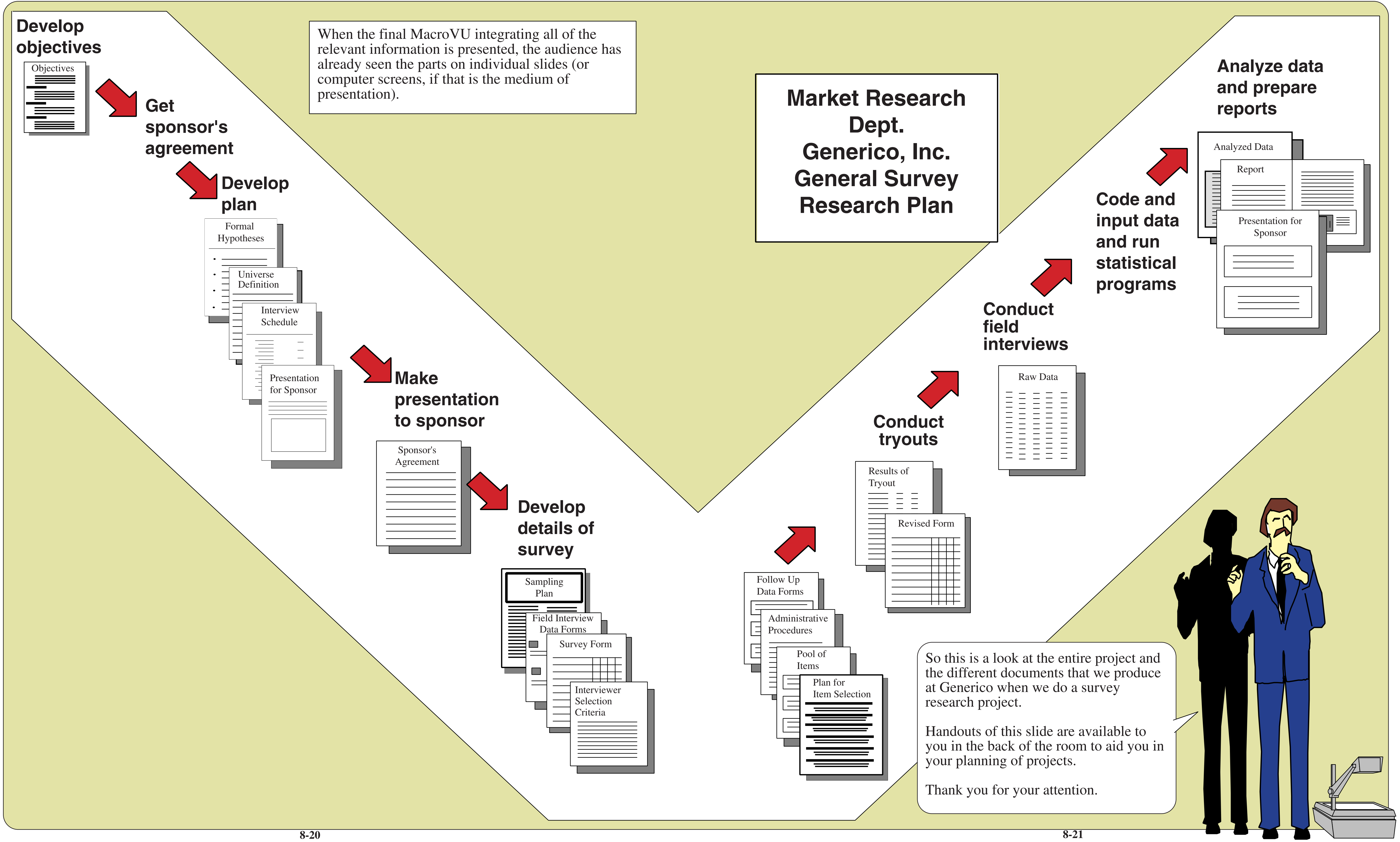
Get sponsor's agreement

Develop plan

Then comes the detailed planning. We always operate with formal hypotheses in our studies. This involves precise operational definitions of the universe of populations that we are going to sample and a schedule of when we are going to do the interviews (which is coordinated with our regional offices). Finally we make a formal presentation document of these plans for the sponsor.

This way of showing each stage in the project, and the gradual building up of the presentation over several slides (these intermediate stages are not shown), permits the presentation of the final MacroVU integrating the whole project, shown on the next page.

Build Up Complicated MacroVU Communication Units One Step at a Time–2



Develop objectives

Get sponsor's agreement

Develop plan

Make presentation to sponsor

Develop details of survey

Conduct tryouts

Conduct field interviews

Code and input data and run statistical programs

Analyze data and prepare reports

When the final MacroVU integrating all of the relevant information is presented, the audience has already seen the parts on individual slides (or computer screens, if that is the medium of presentation).

Market Research Dept.
Generico, Inc.
General Survey Research Plan

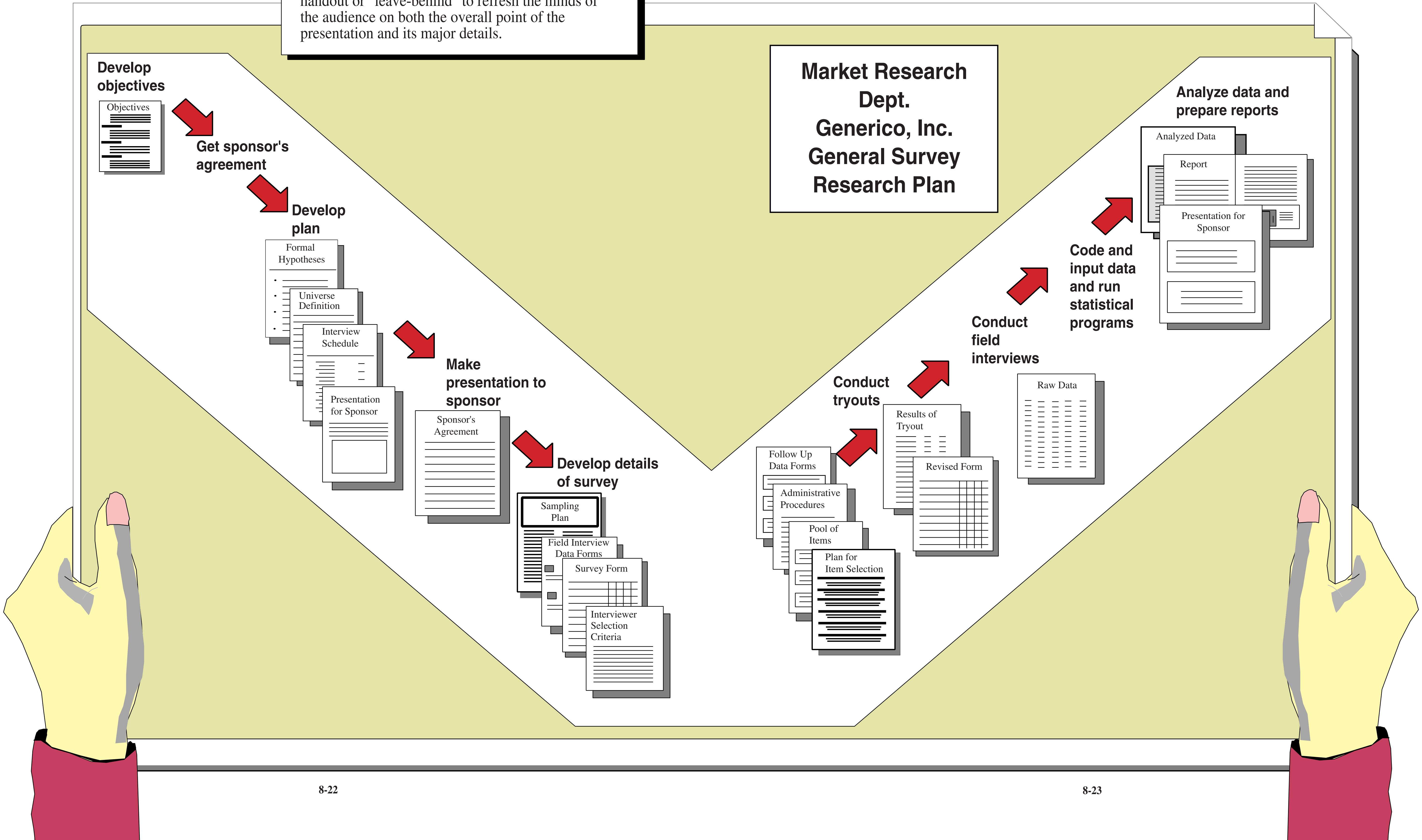
So this is a look at the entire project and the different documents that we produce at Generico when we do a survey research project.

Handouts of this slide are available to you in the back of the room to aid you in your planning of projects.

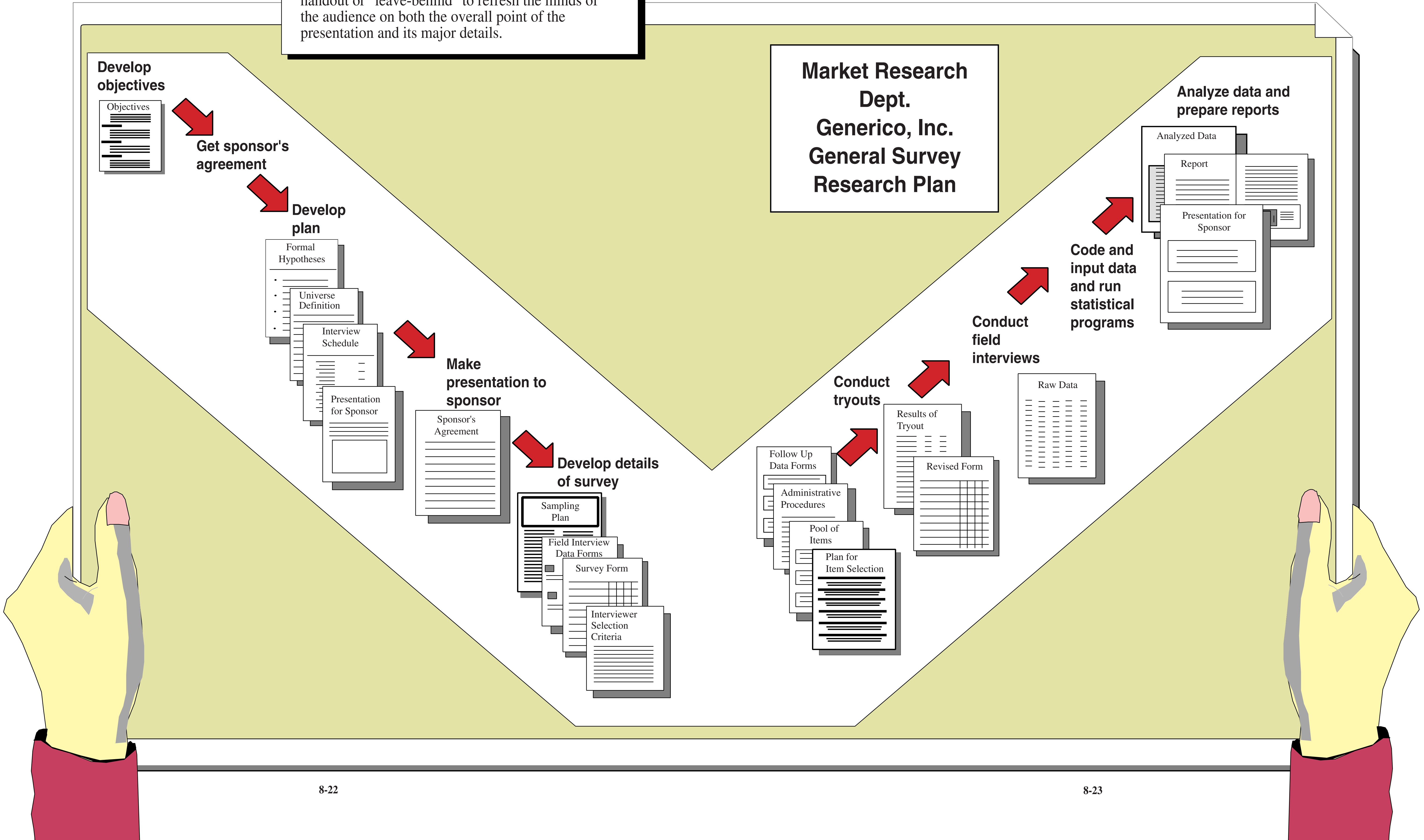
Thank you for your attention.

Build Up Complicated MacroVU Communication Units One Step at a Time–3

The final MacroVU CU can also serve as a paper handout or "leave-behind" to refresh the minds of the audience on both the overall point of the presentation and its major details.



Build Up Complicated MacroVU Communication Units One Step at a Time–3



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Market Research Dept.
Generico, Inc.
General Survey Research Plan

Develop objectives

Get sponsor's agreement

Develop plan

Make presentation to sponsor

Develop details of survey

Conduct tryouts

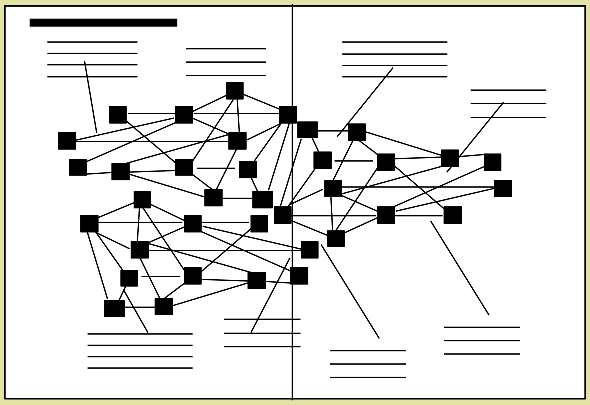
Conduct field interviews

Code and input data and run statistical programs

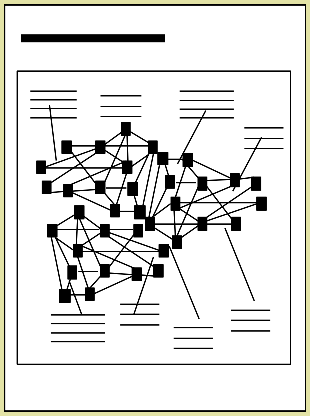
Analyze data and prepare reports

Examples of Formats of MacroVU™ Communication Units

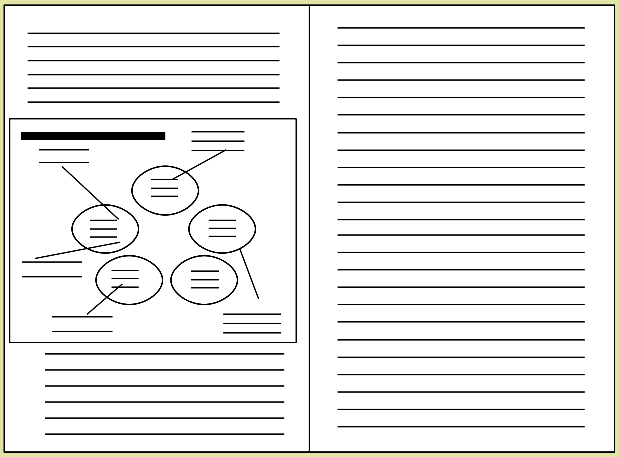
MacroVUs can be displayed on double-page spreads.



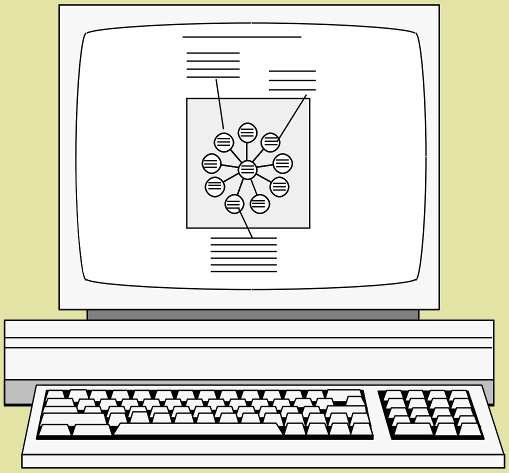
MacroVUs can stand alone as single pages.



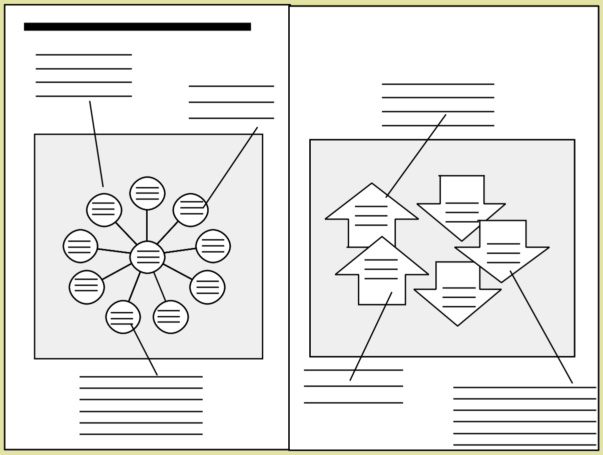
MacroVUs can be embedded in prose documents.



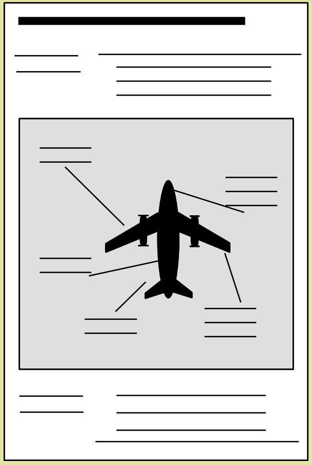
MacroVUs can be displayed on screens.



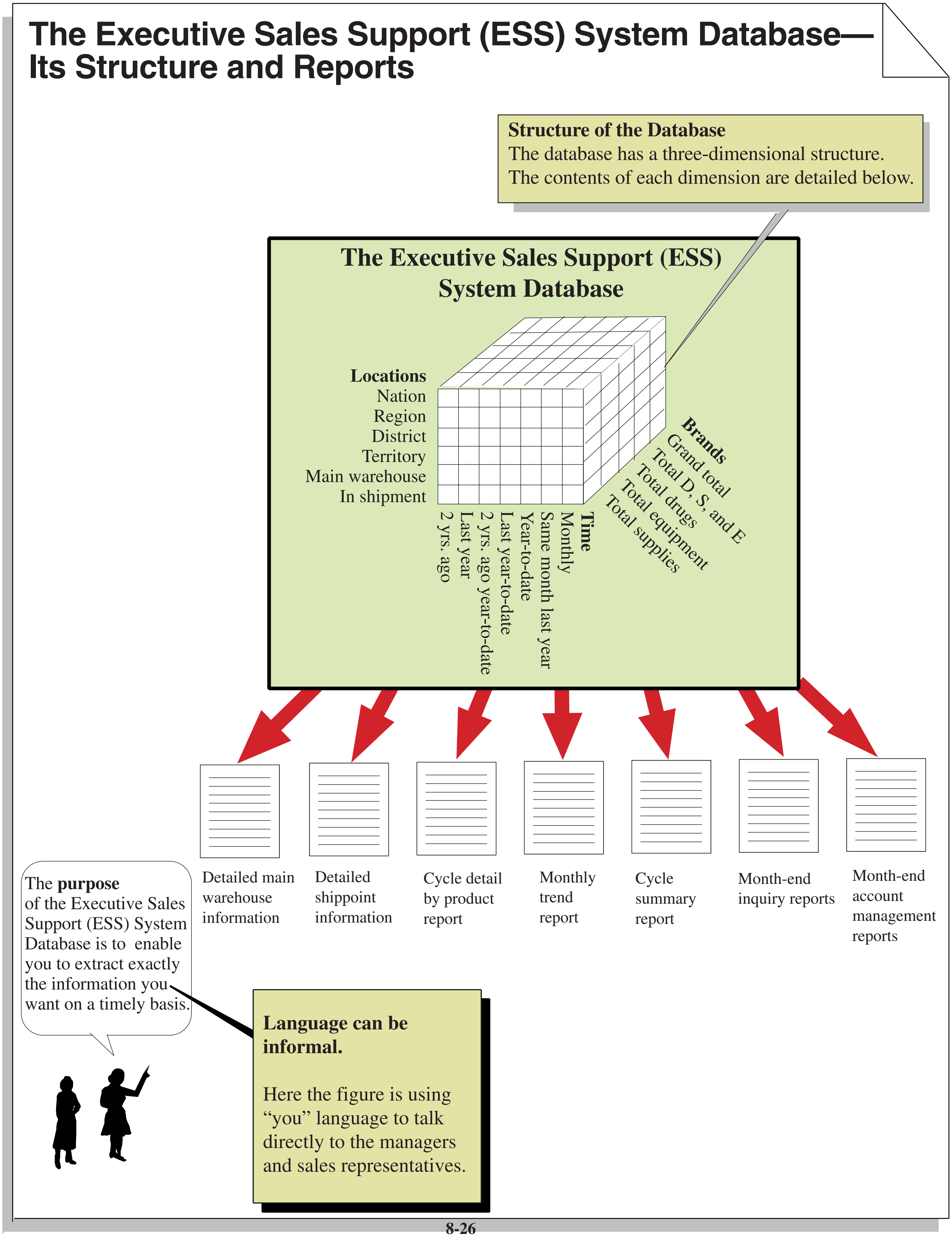
MacroVUs can be a part of a purely MacroVU document.



MacroVUs can be embedded in a sequence of Information Maps.



Example of Talking Figures



The Executive Sales Support (ESS) System Database—Its Structure and Reports

Structure of the Database
The database has a three-dimensional structure.
The contents of each dimension are detailed below.

The Executive Sales Support (ESS) System Database

Locations
Nation
Region
District
Territory
Main warehouse
In shipment

Time
Monthly
Same month last year
Year-to-date
Last year-to-date
2 yrs. ago year-to-date
Last year
2 yrs. ago

Brands
Grand total
Total D, S, and E
Total drugs
Total equipment
Total supplies

- Detailed main warehouse information
- Detailed shippoint information
- Cycle detail by product report
- Monthly trend report
- Cycle summary report
- Month-end inquiry reports
- Month-end account management reports

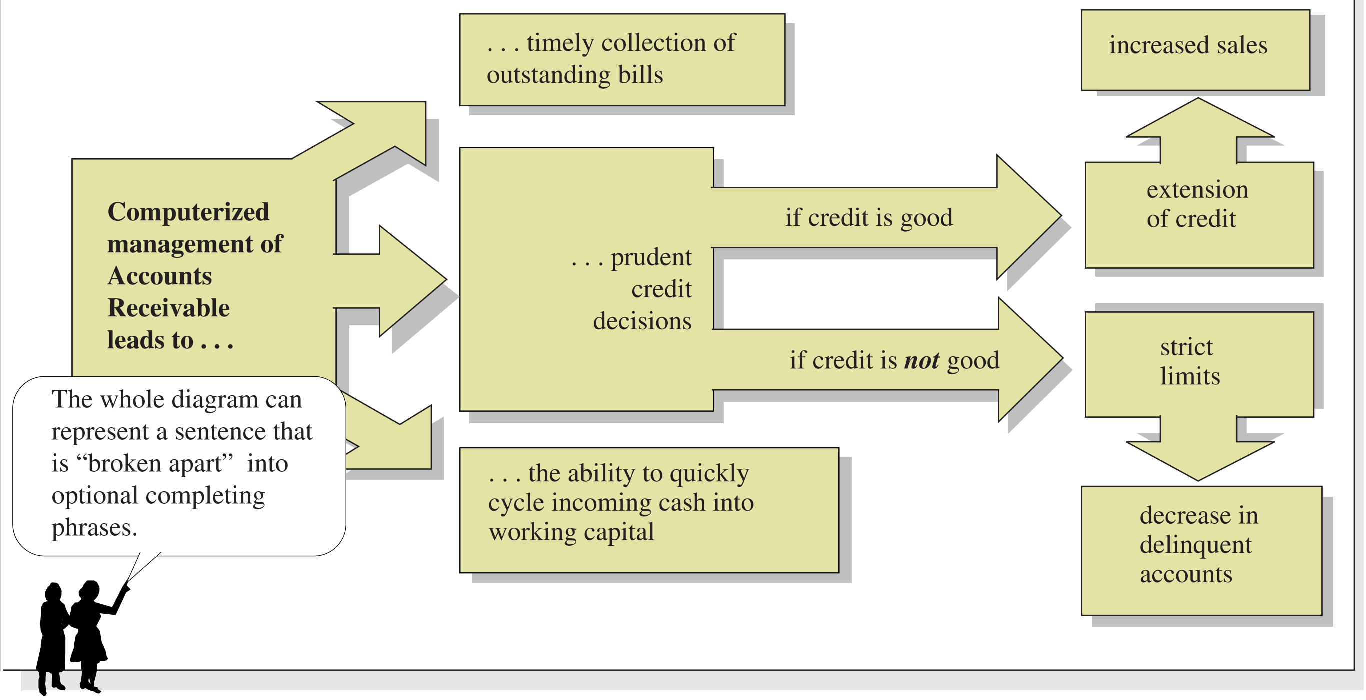
The **purpose** of the Executive Sales Support (ESS) System Database is to enable you to extract exactly the information you want on a timely basis.

Language can be informal.

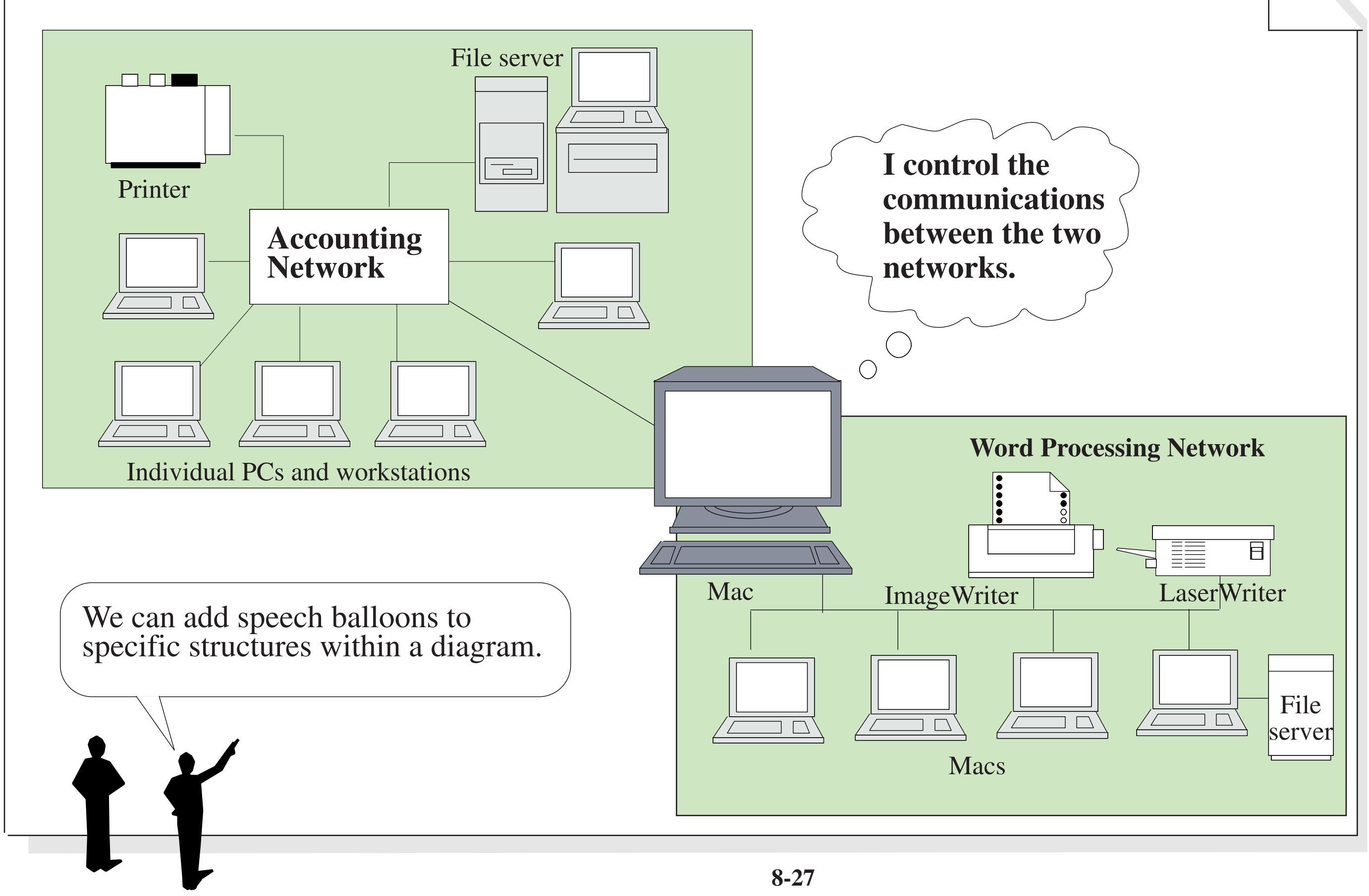
Here the figure is using “you” language to talk directly to the managers and sales representatives.

Examples of Talking Diagrams

What Role Does Computerized Accounts Receivable Play in the Company?


Computerized management of Accounts Receivable leads to . . .
. . . timely collection of outstanding bills
. . . prudent credit decisions
if credit is good
if credit is *not* good
. . . the ability to quickly cycle incoming cash into working capital
increased sales
extension of credit
strict limits
decrease in delinquent accounts
The whole diagram can represent a sentence that is “broken apart” into optional completing phrases.

Linkage Between Our Two Networks


File server
Printer
Accounting Network
Individual PCs and workstations
I control the communications between the two networks.
Word Processing Network
Mac
ImageWriter
LaserWriter
File server
Macs
We can add speech balloons to specific structures within a diagram.

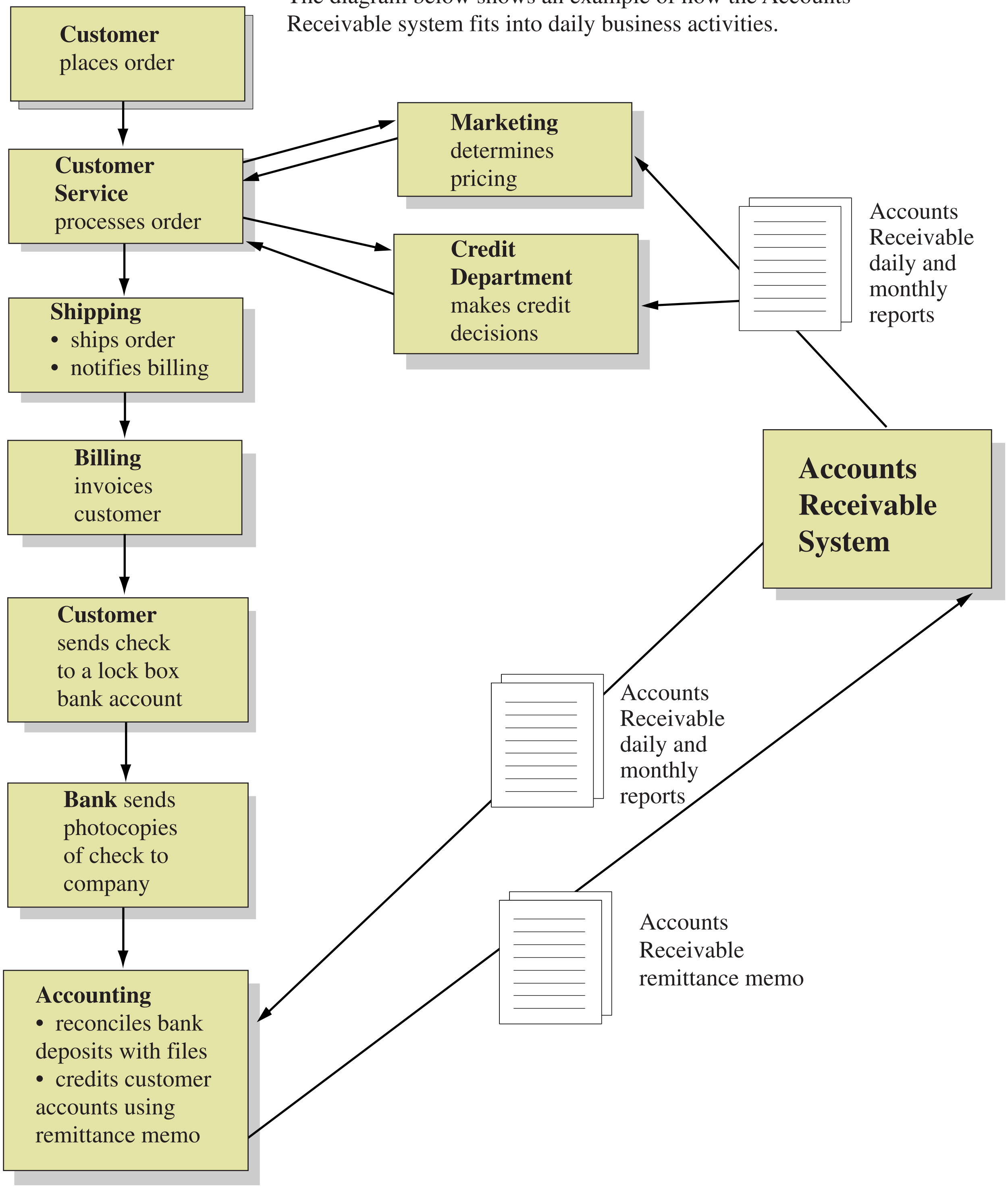
Add a Talking Figure

Exercise

Directions. Draw a talking figure silhouette to indicate the situation as described: The Shipping department has a delay of four or five days in notifying the Billing department that an order has been shipped, and the Billing department has a delay of several days between the time it received the notice from Shipping and the time it invoices the customer.

Accounts Receivable System Daily Activities

The diagram below shows an example of how the Accounts Receivable system fits into daily business activities.

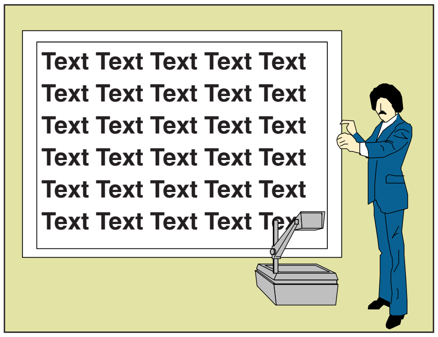

Customer places order
Customer Service processes order
Marketing determines pricing
Credit Department makes credit decisions
Accounts Receivable daily and monthly reports
Shipping
• ships order
• notifies billing
Billing invoices customer
Accounts Receivable System
Customer sends check to a lock box bank account
Accounts Receivable daily and monthly reports
Bank sends photocopies of check to company
Accounts Receivable remittance memo
Accounting
• reconciles bank deposits with files
• credits customer accounts using remittance memo

Suggestions for Verbal Elements—1

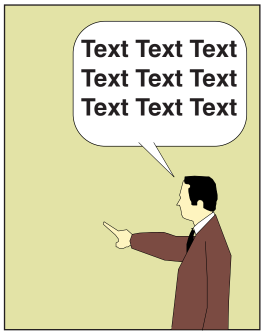
Text with figures pointing

Use figures, or parts of figures, to point out what is exemplified in the central visual elements or other text element. This helps the intended users better identify with the content.

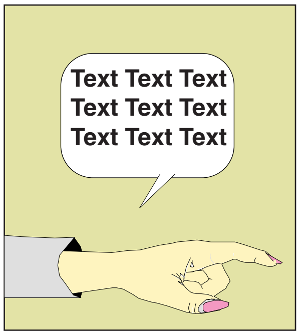
Full figure


Text Text Text Text Text
Text Text Text Text Text
Text Text Text Text Text
Text Text Text Text Text
Text Text Text Text Text
Text Text Text Text Tex

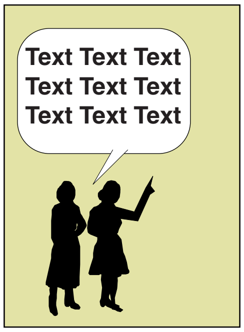
Face, arm, and hand



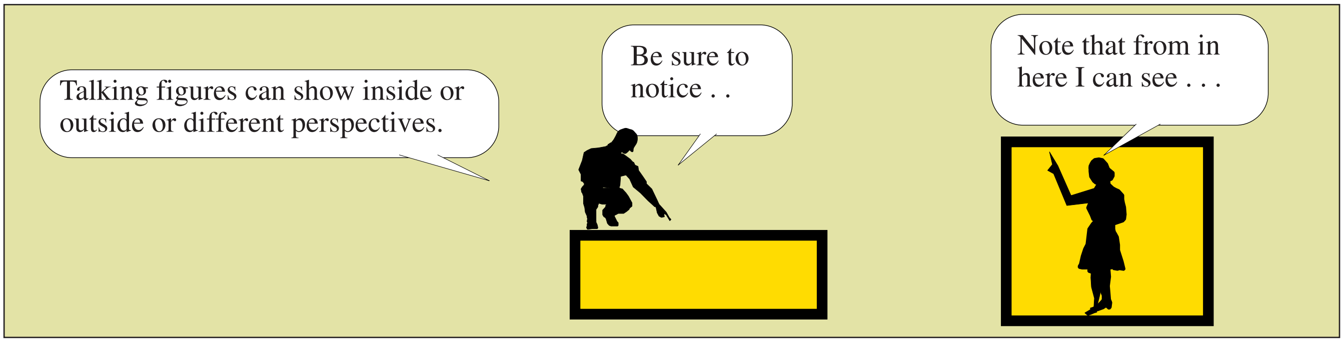
A pointing hand



Silhouettes or cartoon figures

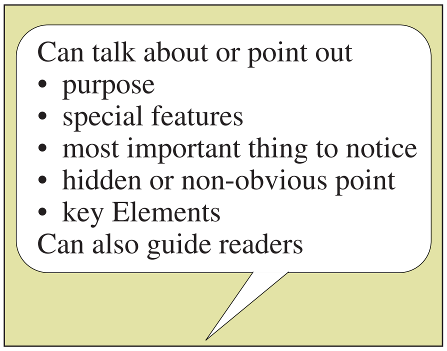


Different points of view


Talking figures can show inside or outside or different perspectives.
Be sure to notice . .
Note that from in here I can see . . .

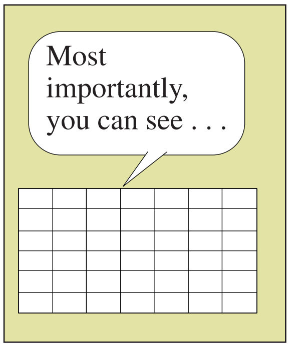
Speech balloons

Borrow from cartoons to enable people, places, and things to speak to reader.


Can talk about or point out
• purpose
• special features
• most important thing to notice
• hidden or non-obvious point
• key Elements
Can also guide readers

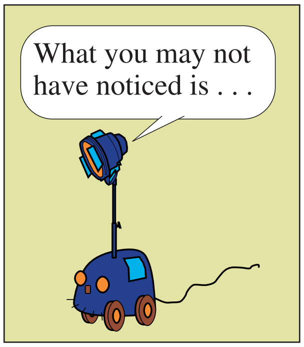
Talking tables

Use talking tables where the headings talk to the reader.


Most importantly, you can see . . .

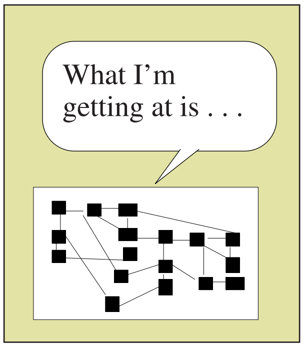
Talking icons

Icons can be used to say things to the reader.


What you may not have noticed is . . .

Talking diagrams

Parts of the diagram may have specific things to say.


What I'm getting at is . . .

Suggestions for Verbal Elements—2

Informal or formal

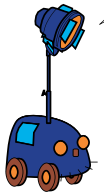
Either formal or more informal language can be used in MacroVUs depending upon the audience and purpose of the communication or document. Informal language may make the message more accessible.

Language in MacroVUs can be formal or informal.

Informal language

Personalized

Anytime you let me talk about myself, that's informal.



Abbreviated headlines

The Times

Diagrams Better With Informal Language

Like newspaper headlines

Acronyms OK . . .

. . . if understood by all readers.

Says NASA.

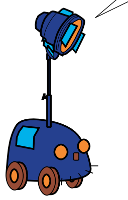
Contractions are OK

I'm . . . he's
. . . they're . . .

Anthropomorphizing OK

Definition: Making inanimate objects have human characteristics . . .

. . . such as talking and smiling.



Short sentences

Informal language uses short sentences.

Jargon

Company jargon, if understood by all, is also OK.

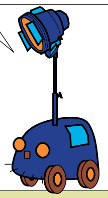
Sentence Fragments

Sentences fragments and phrases OK in informal language.

Not boring.

First/second person

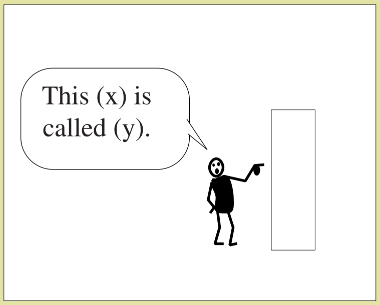
You should use first or second person instead of third person to let me talk to readers.



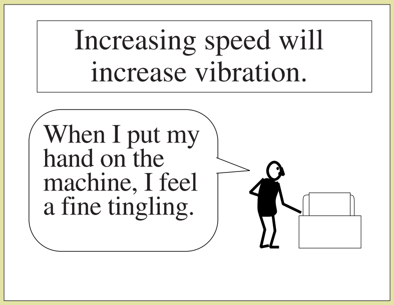
Suggestions for Verbal Elements—3

To Aid Orientation and Identification, Put Thoughts and Speech into the Picture

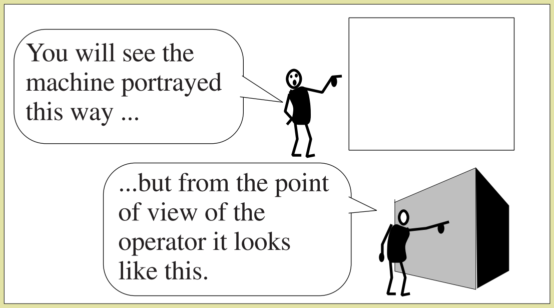
Highlight nomenclature and location


This (x) is called (y).

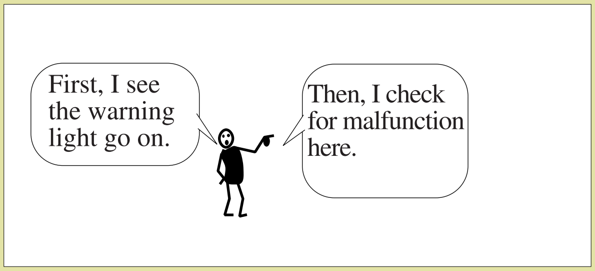
Human reactions in speech


Increasing speed will increase vibration.
When I put my hand on the machine, I feel a fine tingling.

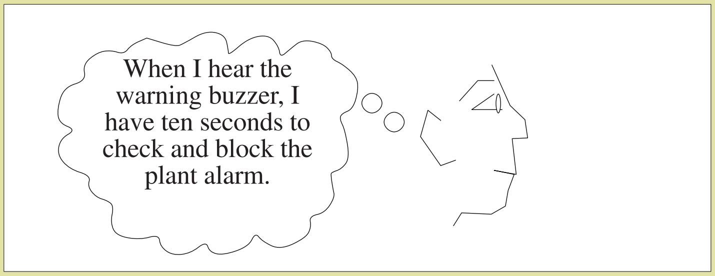
"You language" involves reader


You will see the machine portrayed this way ...
...but from the point of view of the operator it looks like this.

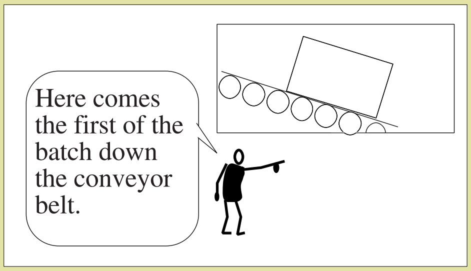
Use "First I see, then I see" language when person is explaining a process


First, I see the warning light go on.
Then, I check for malfunction here.

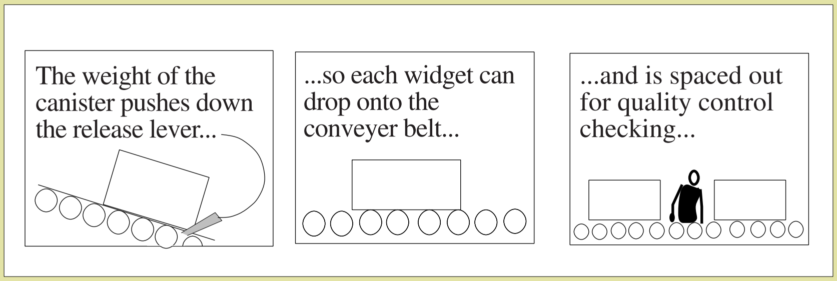
Thought balloons provide informal explanation


When I hear the warning buzzer, I have ten seconds to check and block the plant alarm.

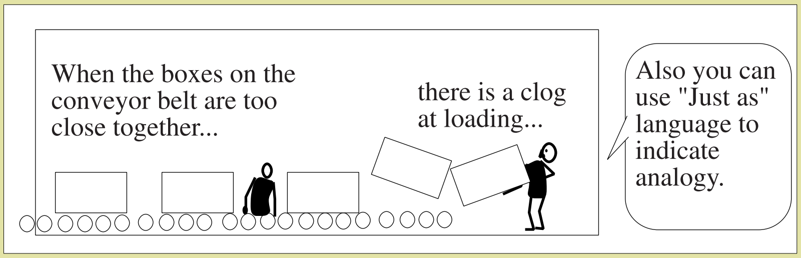
Use "Here comes an (x)" language


Here comes the first of the batch down the conveyor belt.

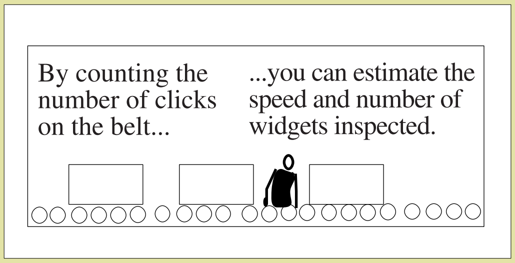
And, but, or, and *so* organize causal sequence for explanation


The weight of the canister pushes down the release lever...
...so each widget can drop onto the conveyer belt...
...and is spaced out for quality control checking...

Use "When (x) happens, then (y) happens"


When the boxes on the conveyor belt are too close together...
there is a clog at loading...
Also you can use "Just as" language to indicate analogy.

Use "by doing (x), you can get (y) language

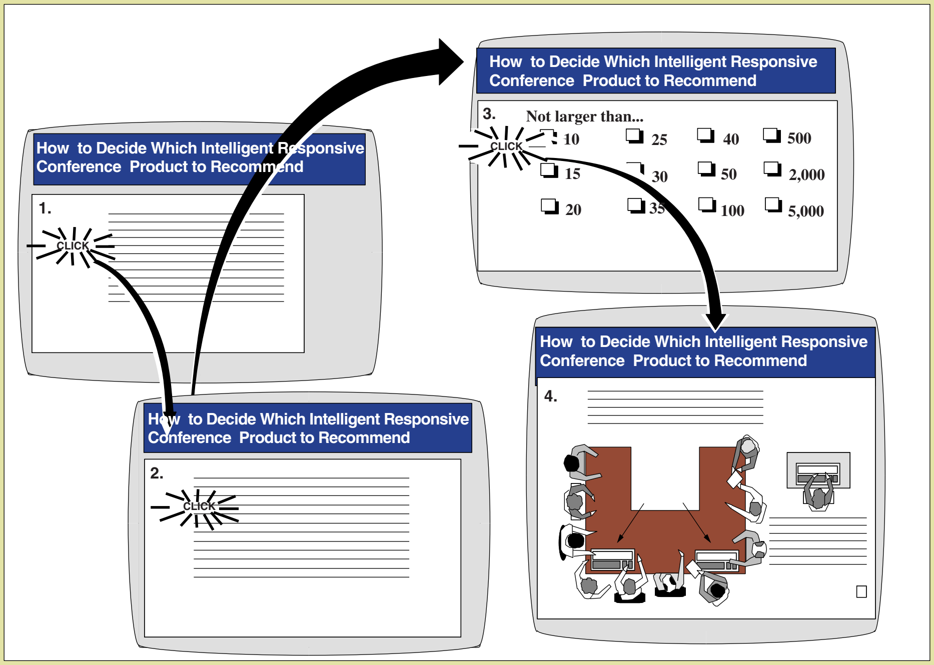

By counting the number of clicks on the belt...
...you can estimate the speed and number of widgets inspected.

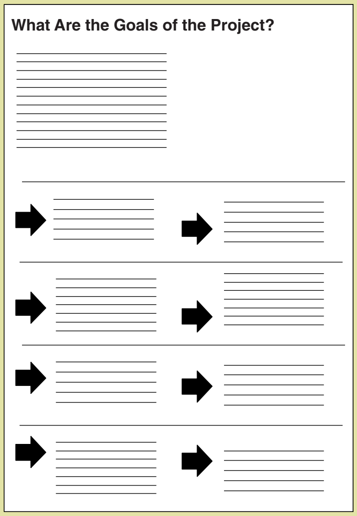
Tools for Guiding the Reader's Eye—1

MacroVU CUs should enable the reader to know where to start reading and in what order. This can be done through a variety of techniques.

Arrows

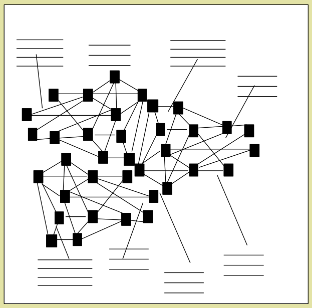
Arrows are powerful tools to guide the reader's eye in the direction we want to go.

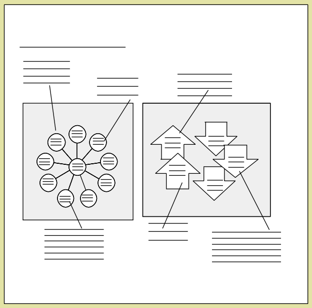

How to Decide Which Intelligent Responsive Conference Product to Recommend
1.
CLICK
How to Decide Which Intelligent Responsive Conference Product to Recommend
2.
CLICK
How to Decide Which Intelligent Responsive Conference Product to Recommend
3.
Not larger than...
CLICK
❑ 10
❑ 25
❑ 40
❑ 500
❑ 15
❑ 30
❑ 50
❑ 2,000
❑ 20
❑ 35
❑ 100
❑ 5,000
How to Decide Which Intelligent Responsive Conference Product to Recommend
4.



Titles and labels

Instead of putting information in text or captions, put identifying and other descriptive information in labels of diagrams. The reader's eye is drawn to such chunks of information. But frequently labels are not enough (see "Alphabets and Numbers" on page 8-34).

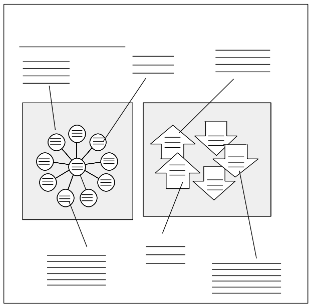




Callout lines

Use light or dotted lines from visual component to label or name.

Lines should cross the shortest distance possible.



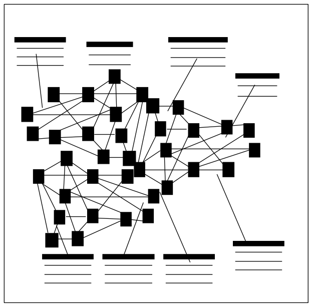
If at all possible, callout lines should ***not cross*** each other.

Callout lines should be used only when label next to or on object will not work or will make a cluttered diagram.

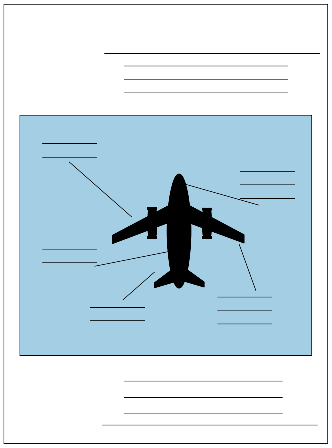
Tools for Guiding the Reader's Eye—2

Key labels and technical terms in boldface

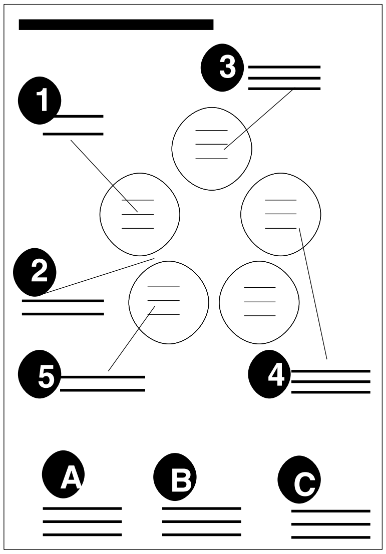
Use boldface and other typographic techniques to assist the reader in scanning the document for



Text very close to related visual component

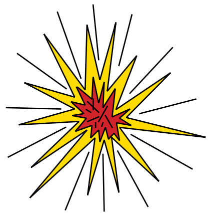


Alphabets and numbers

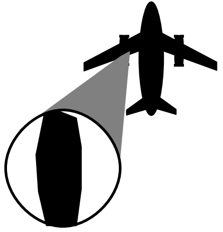


Visual structure for grouping, linking, and focusing

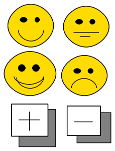
Explosions



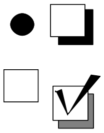
Pop-outs



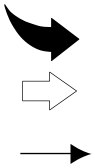
Icons



Abstract focusers

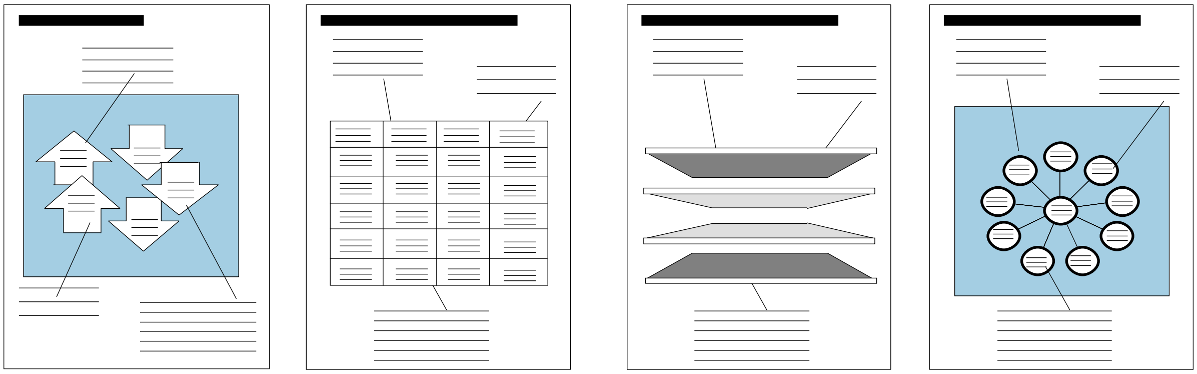


Arrows



Color

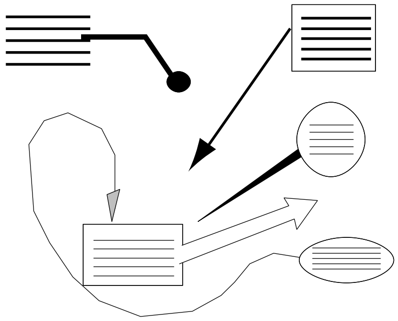
Cluster diagrams



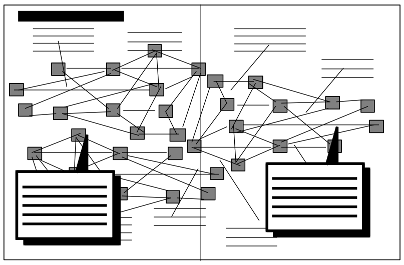
Methods for Showing Layers of Description, Explanation, and Comment

Problem: The problem to be solved with these techniques is the need to have two or more layers of comment that are easily visually identifiable.

Different kinds of callout boxes and arrows

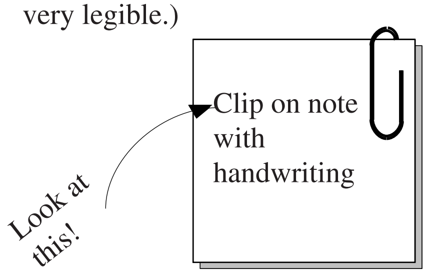


Drop shadow layer

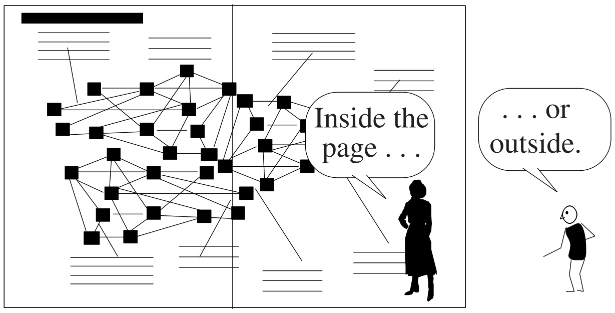


Different typefaces

Simulated handwritten notes are one kind of strikingly different typeface. (Reminder: handwriting should be very legible.)

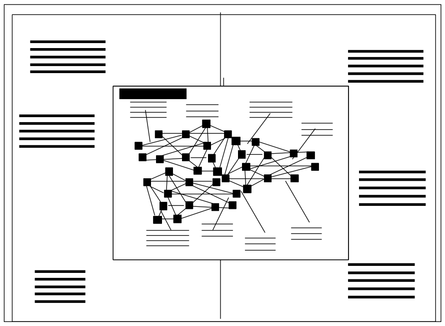

Clip on note with handwriting
Look at this!

Use of figures and speech balloons

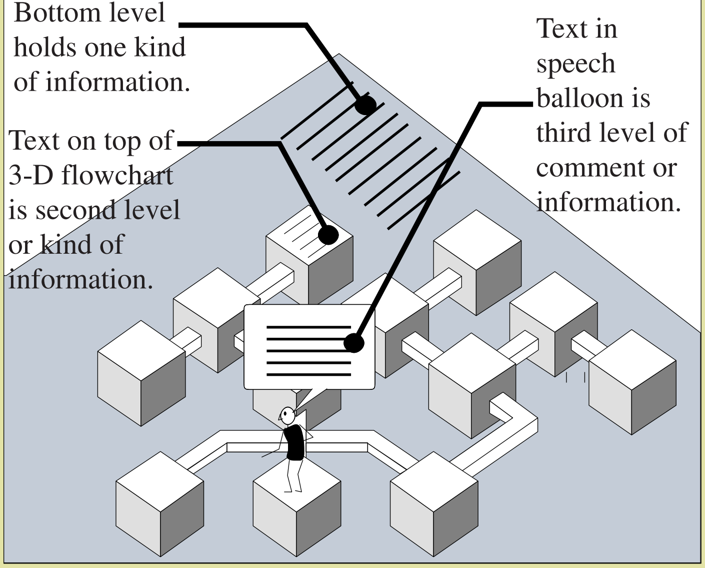


Visual background of document page

Information on the page itself provides one level of information. Commentary outside the boundary of the page provides a second level.



Different 3-D layers



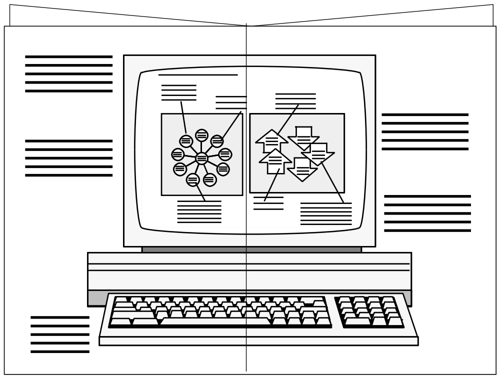
Bottom level holds one kind of information.

Text on top of 3-D flowchart is second level or kind of information.

Text in speech balloon is third level of comment or information.

Visual background of computer screen

Putting a piece of display equipment on the page with a message on the screen provides one level. Commentary outside the boundary of the equipment provides the



Exercise

Idea-Sketch Plan for MacroVU CU

Directions. Analyze this text and plan a MacroVU CU. Sketch roughly how you would show where various blocks of text and figures would go.

The Four Stages of Action Potential

For a neuron to transmit an electrical charge it must react to an electrical stimulation and send that stimulation on down to the end of its axon. Action Potential is a series of gate releases and chemical exchanges across the neuron's cell membrane, which make such transmissions possible (Fig. 1). The process of Action Potential starts with an electrical stimulation causing the Sodium Channel's Fast Activation Gate to open quickly while the Slow Inactivation Gate begins to close slowly. This is sometimes called the resting state.

In the second or depolarization stage, sodium ions rush into the neuron down their concentration gradient (Fig. 2.). Because the sodium ions carry a positive charge they quickly make the inside of the cell positively charged.

The positive charge on the inside of the cell stimulates the Potassium Channel to open. At about this time, the Slow Inactivation Gate closes, preventing further diffusion of Sodium ions. Potassium ions rush out of the cell down their concentration gradient in the third, or repolarization stage (Fig. 3.) Because the Potassium ions are positively charged and are leaving the neuron, this makes the inside of the neuron negatively charged again.

In the fourth or undershoot stage, the Potassium Channel stays open long enough for the charge to become more negative than it was during resting state. Potassium ions continue to diffuse out of the cell and the membrane potential becomes more and more negative (Fig. 4.) This helps to prevent this particular section of the neuron from firing immediately over and over.

The Slow Inactivation Gate remains closed during this period to prevent this particular section of the neuron from firing for a short period. During the resting state, sometimes also called the refractory period, the Sodium Channel and Potassium Channel are both closed.

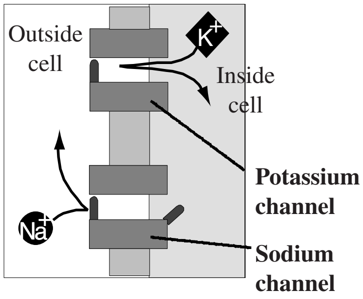


Fig. 1.

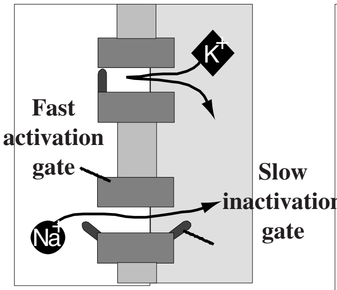


Fig. 2.

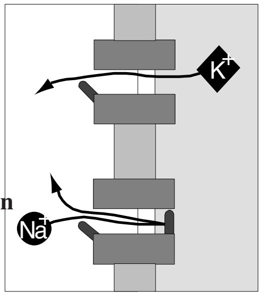


Fig. 3.

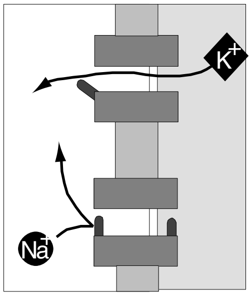


Fig. 4.

KEY

K^+ **Potassium ions**

Na^+ **Sodium ions**

From *Physiology of the Eye: A Review for Pharmaceutical Sales Persons*

Example of a MacroVU™ CU (Early Draft)

The Four Stages of Action Potential

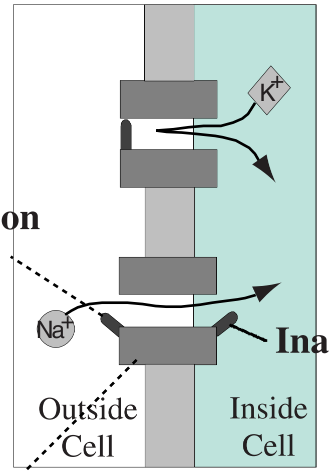
Sodium ions rush into the neuron down their concentration gradient. Because the sodium ions carry a positive charge they quickly make the inside of the cell positively charged.

The positive charge on the inside of the cell stimulates the **Potassium Channel** to open. At about this time, the **Slow Inactivation Gate** closes, preventing further diffusion of Sodium ions.

Definition

Action Potential: For a neuron to transmit an electrical charge it must react to an electrical stimulation and send that stimulation on down to the end of its axon. Action potential is a series of gate releases and chemical exchanges across the neuron's cell membrane which make such transmissions possible.

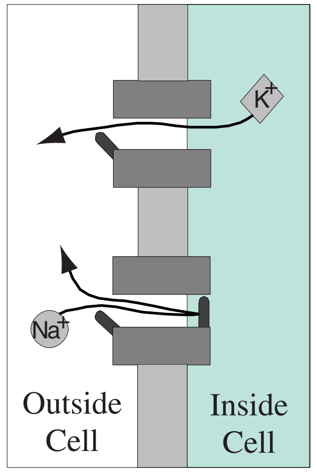
② Depolarization



Fast Activation Gate

Slow Inactivation Gate

③ Repolarization



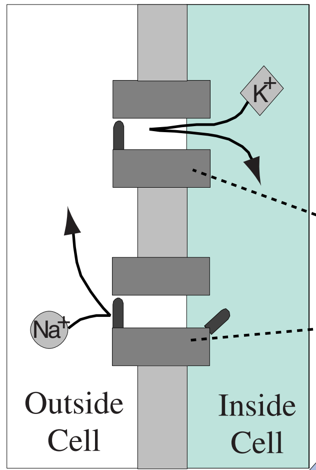
Potassium ions rush out of the cell down their concentration gradient. Because the Potassium ions are positively charged and are leaving the neuron this proves makes the inside of the neuron negatively charged again.

The **Potassium Channel** stays open long enough for the charge to become more negative than it was during resting state.

The process of Action Potential starts with an electrical stimulation causing the **Sodium Channel's Fast Activation Gate** to open quickly while the **Slow Inactivation Gate** begins to close slowly.

① Resting State

START

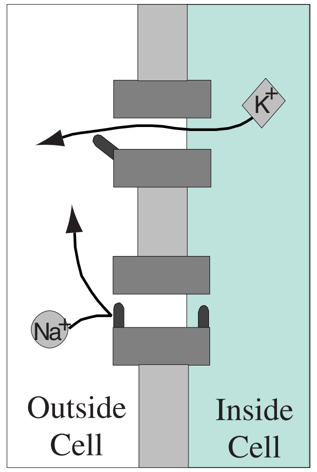


Potassium Channel

Sodium Channel

During the resting state, the **Sodium Channel** and **Potassium Channel** are both closed..

④ Undershoot



Potassium ions continue to diffuse out of the cell and the membrane potential becomes more and more negative. This helps to prevent this particular section of the neuron from firing immediately over and

Refractory Period

The Slow Inactivation Gate remains closed during this period to prevent this particular section of the neuron from firing for a short period.

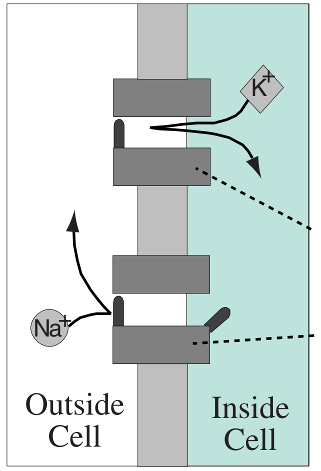
Example of a MacroVU™ Communication

The Four Stages of Action Potential

Definition. Action Potential: For a neuron to transmit an electrical charge it must react to an electrical stimulation and send that stimulation on down to the end of its axon. Action potential is a series of gate releases and chemical exchanges across the neuron's cell membrane which make such transmissions possible.

START

❶ Resting State



Potassium Channel

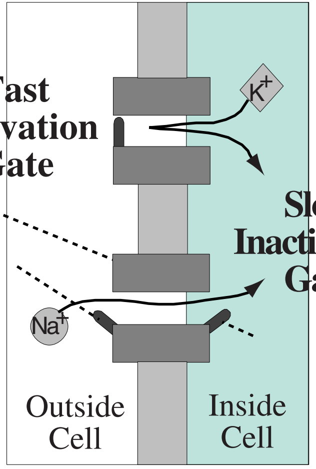
Sodium Channel

The process of Action Potential starts with an electrical stimulation causing the **Sodium Channel's Fast Activation Gate** to open quickly while the **Slow Inactivation Gate** begins to close slowly.

Refractory Period

During the resting state, the **Sodium Channel** and **Potassium Channel** are both closed.

❷ Depolarization



Fast Activation Gate

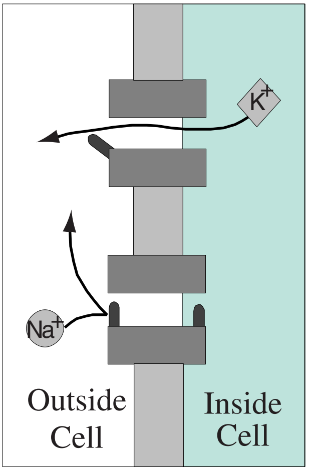
Slow Inactivation Gate

Sodium ions rush into the neuron down their concentration gradient. Because the sodium ions carry a positive charge they quickly make the inside of the cell positively charged.

The positive charge on the inside of the cell stimulates the **Potassium Channel** to open. At about this time, the **Slow Inactivation Gate** closes, preventing further diffusion of Sodium ions.

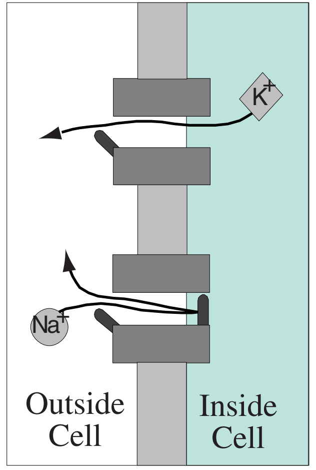
❹ Undershoot

The **Slow Inactivation Gate** remains closed during this period to prevent this particular section of the neuron from firing for a short period.



Potassium ions continue to diffuse out of the cell and the membrane potential becomes more and more negative. This helps to prevent this particular section of the neuron from firing immediately over and over.

❸ Repolarization



Potassium ions rush out of the cell down their concentration gradient. Because the Potassium ions are positively charged and are leaving the neuron this makes the inside of the neuron negatively charged again.

The Potassium Channel stays open long enough for the charge to become more negative than it was during resting state.

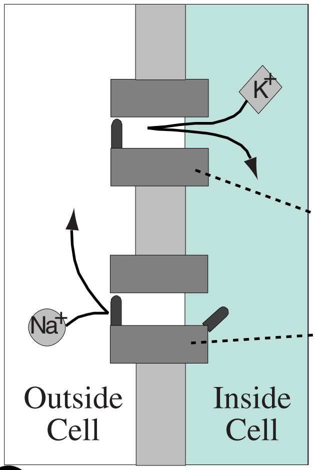
Example of a MacroVU™ Communication Unit

The Four Stages of Action Potential

Definition. Action Potential: For a neuron to transmit an electrical charge it must react to an electrical stimulation and send that stimulation on down to the end of its axon. Action potential is a series of gate releases and chemical exchanges across the neuron's cell membrane which make such transmissions possible.

START

Resting State



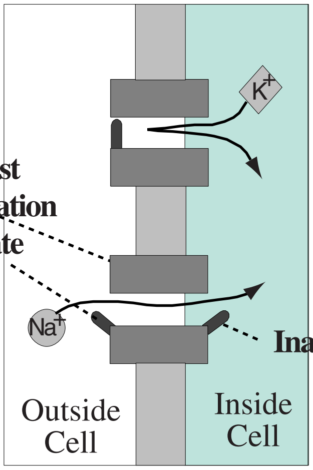
Potassium Channel

Sodium Channel

1

The process of Action Potential starts with an electrical stimulation causing the **Sodium Channel**'s **Fast Activation Gate** to open quickly while the **Slow Inactivation Gate** begins to close slowly.

Depolarization



Fast Activation Gate

Slow Inactivation Gate

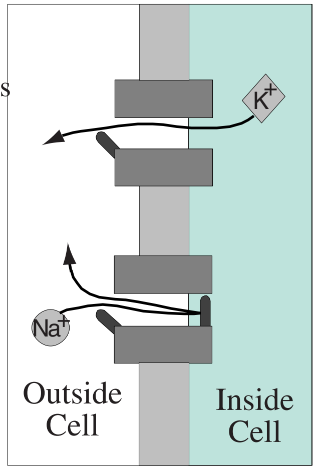
2

Sodium ions rush into the neuron down their concentration gradient. Because the sodium ions carry a positive charge they quickly make the inside of the cell positively charged.

3

The positive charge on the inside of the cell stimulates the **Potassium Channel** to open. At about this time, the **Slow Inactivation Gate** closes, preventing further diffusion of Sodium ions.

Repolarization



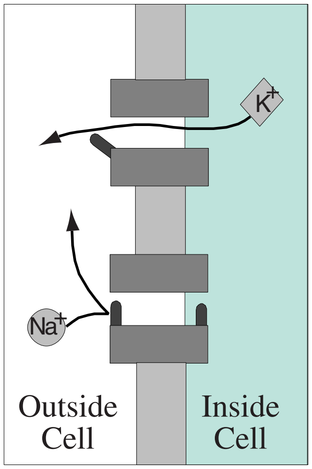
4

Potassium ions rush out of the cell down their concentration gradient. Because the Potassium ions are positively charged and are leaving the neuron this makes the inside of the neuron negatively charged again.

5

The **Potassium Channel** stays open long enough for the charge to become more negative than it was during resting state.

Undershoot



6

Potassium ions continue to diffuse out of the cell and the membrane potential becomes more and more negative. This helps to prevent this particular section of the neuron from firing immediately over and over.

7

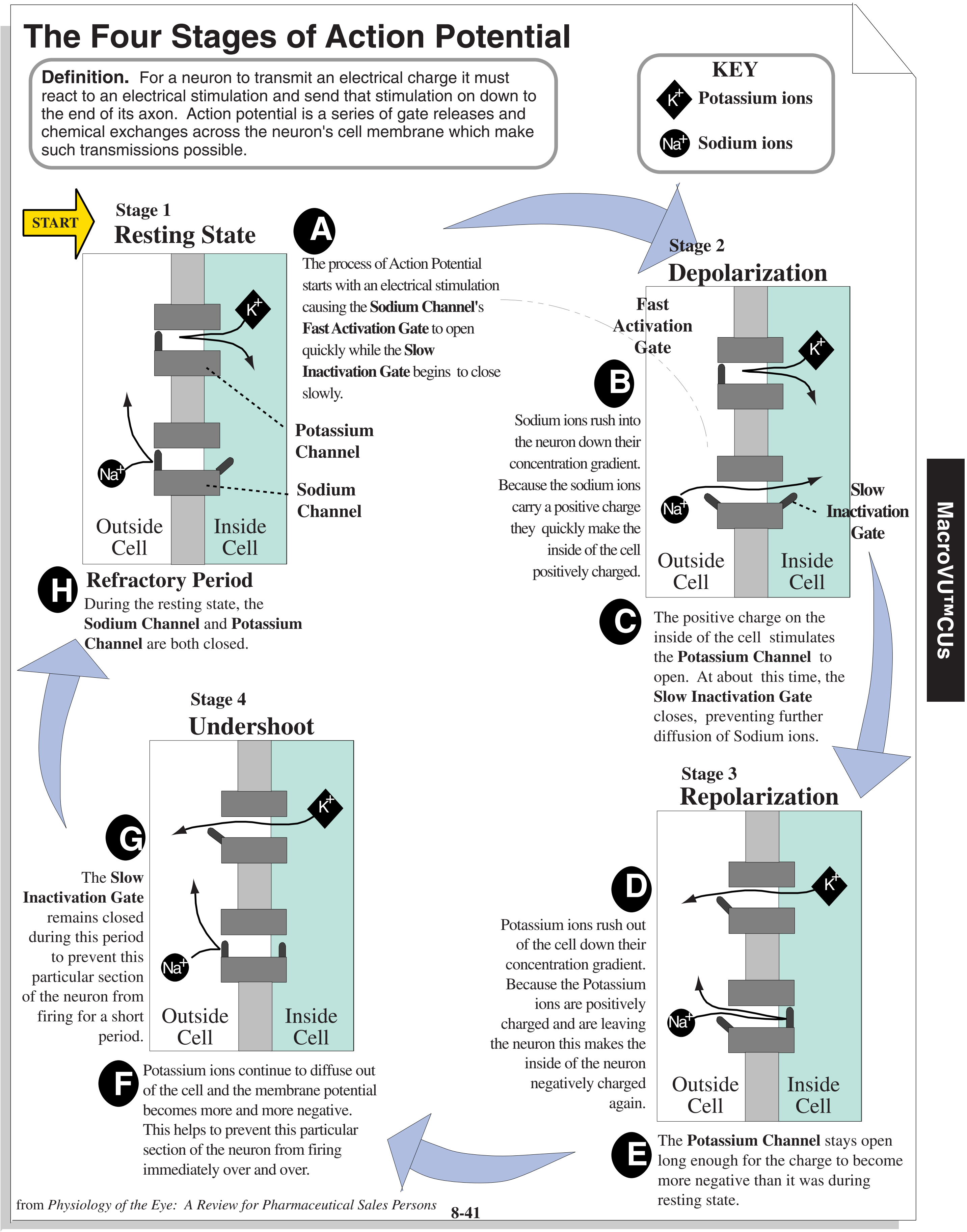
The **Slow Inactivation Gate** remains closed during this period to prevent this particular section of the neuron from firing for a short period.

8

Refractory Period

During the resting state, the **Sodium Channel** and **Potassium Channel** are both closed.

Example of a MacroVU™ Communication Unit



The Four Stages of Action Potential

Definition. For a neuron to transmit an electrical charge it must react to an electrical stimulation and send that stimulation on down to the end of its axon. Action potential is a series of gate releases and chemical exchanges across the neuron's cell membrane which make such transmissions possible.

KEY

- K+ **Potassium ions**
- Na+ **Sodium ions**

Stage 1
Resting State

A The process of Action Potential starts with an electrical stimulation causing the **Sodium Channel's Fast Activation Gate** to open quickly while the **Slow Inactivation Gate** begins to close slowly.

Stage 2
Depolarization

B Sodium ions rush into the neuron down their concentration gradient. Because the sodium ions carry a positive charge they quickly make the inside of the cell positively charged.

C The positive charge on the inside of the cell stimulates the **Potassium Channel** to open. At about this time, the **Slow Inactivation Gate** closes, preventing further diffusion of Sodium ions.

Stage 3
Repolarization

D Potassium ions rush out of the cell down their concentration gradient. Because the Potassium ions are positively charged and are leaving the neuron this makes the inside of the neuron negatively charged again.

E The **Potassium Channel** stays open long enough for the charge to become more negative than it was during resting state.

Stage 4
Undershoot

F Potassium ions continue to diffuse out of the cell and the membrane potential becomes more and more negative. This helps to prevent this particular section of the neuron from firing immediately over and over.

G The **Slow Inactivation Gate** remains closed during this period to prevent this particular section of the neuron from firing for a short period.

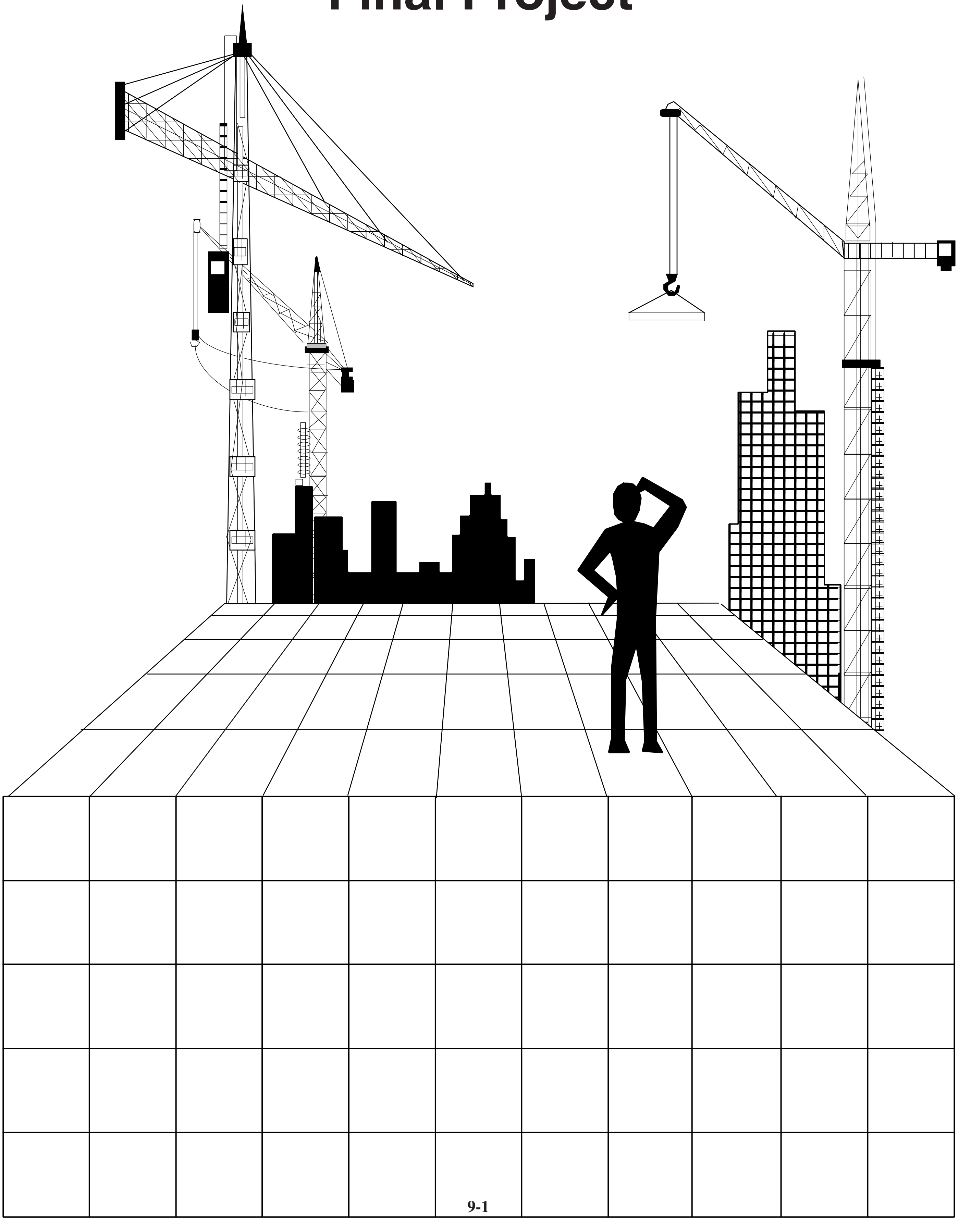
H **Refractory Period**

During the resting state, the **Sodium Channel** and **Potassium Channel** are both closed.

from *Physiology of the Eye: A Review for Pharmaceutical Sales Persons*

Chapter 9

Final Project



Final Project

Directions. Sketch out a briefing with MacroVU CUs. Use all of what you have learned in the course. You may want to use the Gamma System Briefing (pp. A-1 to A-10) for ideas. You can think of the briefing to be presented on overhead projector, computer screen, or paper.

Topics for final project

The topic of the briefing can be any one of six topics listed below.

1. Plan for the new Spotmobile Test Range
2. Plan to use Spotmobile technology in emerging robotics markets such as healthcare, transportation, manufacturing, etc.
3. Report of a Spotmobile test in Hollywood or Washington, D. C.
4. Plan for a new product introduction of Spotmobile II
5 Options for customization of new Spotmobile II
6. The plan for a new information system for any part of Spotmobile, Inc.
7. Any other similar project report or plan that your group wants to do.

Recommended Reading for the MacroVU™ Course

Examples of visual language used throughout book
Horn, Robert E., (1989) *Mapping Hypertext: Analysis, Linkage, and Display of Knowledge for the Next Generation of On-Line Text and Graphics.* (available from Information Mapping, Inc. 300 Third Avenue, Waltham, MA 02154, phone 1-800-627-4544 or 617-890-7003).

Horn, R. E. (1992) *How High Can It Fly? Examining the Evidence on Information Mapping's Method of High Performance Communication,* Lexington, MA, The Lexington Institute (available from Information Mapping, Inc. 300 Third Avenue, Waltham, MA 02154, phone 1-800-627-4544 or 617-890-7003).

Horn, R. E., (1998) *Visual Language: Global Communication for the 21st Century,* Bainbridge Island, WA: MacroVU, Inc., 1998. Presents a linguistic theory of visual language as well as historical and other material. Material on visual language is presented in visual language.

Macaulay, David (1988) *The Way Things Work,* Boston, Houghton Mifflin. Great for process diagrams of all kinds of common processes. Many of these are what could be called MacroVU™ wanabees in that they come close, but also many fall short of a full explanation.

Icons and VLicons
Horton, William, (1994) *The Icon Book: Visual Symbols for Computer Systems and Documentation,* N.Y., John Wiley. Excellent review of the relevant literature on icons. Generally has the approach that icons will exist separately from words, rather than being combined as in VLicons™ taught in the MacroVU™ course, so should be read critically from that standpoint.

Dreyfus, Henry, (1984) *Symbol Sourcebook: An Authoritative Guide to International Graphic Symbols,* N.Y., Van Nostrand Reinhold. A reference source of almost all of the standard international symbols and icons.

Time, motion, and other visual conventions
McCloud, Scott, (1993) *Understanding Comics: The Invisible Art,* Northampton, MA, Kitchen Sink Press.

Quantitative charts and graphs
Zelazny, Gene, (1991) *Say it With Charts,* Homewood, IL, Business One Irwin. Excellent introduction with profuse business examples. Much of quantitative section of course is congruent with recommendations here.

Kosslyn, Stephen M. (1994) *Elements of Graph Design,* N. Y., W. H. Freeman. Excellent collection of the do's and don'ts of using quantitative charts and graphs.

Edward Tufte (1983) *The Visual Display of Quantitative Information.* Graphics Press, Cheshire Connecticut. By now a classic in appreciating charts and graphs, especially on the aesthetics.

Edward Tufte (1990) *Envisioning Information.* Graphics Press, Cheshire Connecticut. Author's second book expanding on topics introduced in first.

Color

White, Jan V. (1990) *Color for the Electronic Age,* N.Y., Watson-Guptill. Not oriented toward integration of words and images, but good on color fundamentals.

Research on using graphics with text

Horton, W., (1991) *Illustrating Computer Documentation-- The Art of Presenting Information Graphically in Paper and Online,* N. Y., Wiley. Excellent compilation of research on visual components. Must be read with the view that the either visuals or words approach persists in the author's approach. Recommend reading chapter on page as a picture critically because of the new standpoint of the integration of text and graphics suggested in the MacroVU course. Very good technical and business examples.

Clip art

Glover, Gary, (1994) *Clip Art–Image Enhancement,* N. Y., McGraw-Hill.

Graphics for computer

Paddock, Bruce T., (1993) *Graphics for the Desktop Publisher,* N. Y., Henry Holt .

Works Cited

Chandler, P. and Sweller, J. (1992) The Split-Attention Effect as a Factor in the Design of Instruction, *British Journal of Educational Psychology*, 62, 233-246.

Dreyfuss, Henry, (1984) *Symbol Sourecebook: An Authoritative Guide to International Graphic Symbols,* N.Y., Van Nostrand Reinhold.

Durrett, H. J. and Stimmel, D. T., "Color and the Instructional Use of the Computer," in Durrett, H. J. (ed.) (1987), *Color and the Computer,* Boston Academic Press.

Horton, W., (1991) *Illustrating Computer Documentation-- The Art of Presenting Information Graphically in Paper and Online,* N. Y., Wiley.

Krebs, M. J., Wolf, J. D., and Sandvig, J. H. (1978), *Color Display Design Guide,* Office of Naval Research Report ONR-CR213-136-2F.

Oppenheim, L, Kydd, C, Carroll, V. P., and Carroll, G. (1981), *A Study of the Effects of the Use of Overhead Transparencies on Business Meetings,* Office of Educational Services & Research, School of Medicine and Wharton Applied Research Center, The Wharton School, University of Pennsylvania.

Rock, I., (1984) *Perception,* N.Y., W. H. Freeman.

Smith, Wanda, (1987) "Ergonomic Vision" in Durrett, 1987.

Teichner, W. H. (1979) "Color and visual information coding," Proceedings of the Society for Information Display (20/1).

Glossary

clus • ter di • a • grams Any one of a group of specific shapes and assemblies of shapes used to combine and display images, words, or other shapes on a page or display screen.

cog • ni • tive sci • ence The use of interdisciplinary scientific methods to study how human beings think, perceive, and learn, especially from the point of view of how they process information. Hence, information processing models based on computers are frequently used to frame issues and problems. Often incorporates psychology, linguistics, philosophy, and computer science.

func • tion • al se • man • tics The study of the purpose for including each element in a visual language communication unit. Hence, the study of what job each verbal or visual element is doing.

ge • stalt **1.** A pattern or structure. **2.** In perception, a group of parts that are seen as a whole.

i • con **1.** Any relatively small pictures or symbols used to identify or represent things or ideas. **2.** Small pictures or symbols used to identify tools, documents, commands, etc. on computer interfaces. Syn. logograph, glyph, (sometimes) pictograph.

in • for • ma • tion de • sign The art and science of preparing information so that it can be used by human beings with efficiency and effectiveness. Its primary products appear as documents or slides and as presentations on computer screens. Often includes the design of forms and interactive media.

Ma • cro • VU™ Com • mu • ni • ca • tion Un • it. **1.** Moderately sized, meaningful combinations of words, images, and shapes constituting a complete communication unit. Their visual and verbal elements are tightly integrated. MacroVU Communication Units are as self-contained as possible on one or two pages or a large screen. Usually contain central visual element(s) and one or more blocks of text. **2.** A trademark for the visual language work of Robert E. Horn. Syn. information graphic, infographic (in newspaper and magazine graphics).

re • sem • blances Any drawing, illustration, painting, photograph that looks like what it represents. Used to distinguish parts of communication units from more abstract elements or representations.

rhe • tor • ic **1.** (originally) The study of the means of persuasion in verbal discourse **2.** The study of the methods and means of communication 3. Recently has come to mean empty, false.

rhe • tor • i • cal func • tions Parts of pages or screens that give readers directions, instructions, and organizational messages.

se • man • tics The study of meaning.

syn • tax **1.** (in linguistics) The way in which basic components, words, are put together in phrases, clauses, and sentences [fr. GK. syntaxis arrangement]. **2.** (in visual language) The study of the combinations and relationships of verbal and visual elements, specifically the identification of the permissible combinations of components.

vis • u • al lan • guage **1.** The integration of words, images, and shapes into a single communication unit. **2.** The use of words and images or words and shapes to form a single communication unit.

VLi • con™ **1.** Any relatively small pictures or symbols combined with a label and used to identify or represent things or ideas in visual language; hence an icon used with words. **2.** A trademark used by Robert E. Horn.

Functional Semantics

Chapter 2

Rhetorical functions

- Guide readers (2-4)
- Focus attention (2-4)
- Organize overall page design and separate chunks of information (2-5)
- Cluster visual and verbal elements (2-5)
- Cue action (2-6)
- Increase impact (2-6)
- Provide lightness and humor (2-7)
- Influence judgment (2-7)

Subject matter functions

- Show physical objects (2-9)
- Show location of objects (2-9)
- Portray invisible forces, relationships, influences (2-10)
- Show how something is done (2-10)
- Define terms (2-11)
- Label and name (2-11)
- Provide comparisons (2-12)
- Show examples (2-12)

Cluster Diagrams

Chapter 3

Basic ideas

- Clustering and Gestalt theory (3-2)
- Definition (3-4)
- Varieties of cluster diagrams (3-6 to 3-7)
- Multiple ways of showing visual syntax of hierarchy (3-10 to 3-11)

Icons and VLicons™

Chapter 4

Basic ideas

- Design context (4-4)
- Definitions (4-2 to 4-3)
- Visual components (4-9)
- Verbal components (4-10)
- Clip art (4-16)
- Selected sources of clip art (4-18)

Icons and VLicons™

Chapter 4, cont.

Functional semantics of Icons and VLicons

Major functions

- Identify/help discriminate among topics (4-5)
- Focus attention (4-5)
- Label blocks of text for function or content (4-5)
- Reinforce or remind the reader of ideas (4-5)

Emotional-cognitive functions

- Add or maintain visual interest (4-5)
- Make a comment (4-5)
- Set a mood (4-5)

Organizing and showing components functions

- Organize space (4-5)
- Use as parts of diagrams (4-5)

Learning and administrative functions

- Augment readability (4-5)
- Increase scanning and retrieval speed (4-5)
- Reinforce remembering (4-5)
- Reduce amount of text (4-5)
- Reduce and simplify translation (4-5)

Design Considerations

- Realistic, detailed or stylized, flat (4-6)
- 2D or 3D (4-6)
- Part or whole (4-6)
- Foreground only or figure and frame (4-6)
- Frame (4-6)
- Direction of reading (4-6)
- Viewpoint (4-6)
- Style (4-7)
- Metaphor (4-7)
- Abstract/symbolic or realistic (4-7)
- National/regional/cultural (4-7)
- Historical changes (4-7)

Types of vocabulary

- Verbs (4-8)
- Nouns (4-8)
- Negations (4-8)
- Warnings (4-8)

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Diagram Prototypes™

Chapter 5

Components of diagrams

- Principles (5-4 to 5-6)
- Structural/organizational diagrams (5-8 to 5-9)
- When to use different levels (5-10)

- Basic visual elements of diagrams (5-2 to 5-3)
- Basic verbal elements of diagrams (5-4)

Time: showing intervals

- Space between frames (5-16)
- Clocks (5-16)
- Words (5-16)
- Arrow (5-16)
- Calendars (5-16)
- Popp arrows (5-16)
- Icons for natural events (5-16)
- Icons for holidays and seasons (5-16)
- Weather or seasonal change (5-16)
- Gantt charts and schedules (5-16)

Time: showing important dates

- Use arrows and calendars (5-17)
- Use desk calendars (5-17)
- Use pop-outs (5-17)
- Use drama (5-17)
- Use posters and arrows (5-17)
- Use pictographs (5-17)

Motion (5-19 to 21)

Resemblances

Chapter 6

Basic ideas

- Point of view (6-2)
- When to use photographs and drawings (6-9)

Types of geometric projection

- Isometric (axonometric) projections (6-3)
- Flowchart in isometric projection (6-3)
- Clinographic (oblique) projections (6-3)
- Cavalier (cabinet, military) projections (6-3)
- Contour projections (6-3)

Internal structure and parts

- Wireframe (6-4)
- Exploded (6-4)
- Ghosted diagram (6-4)
- Cutaway diagram (6-4)
- Cross section (6-4)
- Internal plan (6-4)

Level of detail (6-5)

Perspective projections

- One-point perspective (6-6)
- Two-point perspective (6-6)
- Three-point perspective (6-6)

Style and method of rendering

- Line drawing (6-7)
- Line drawing with gray fill (6-7)
- Soft edge (6-7)
- Silhouette (6-7)
- Cartoon (6-7)
- Strong shadows (6-7)
- Pen and ink (6-7)
- Suggestive (6-7)

Measurements

- Measurements by comparison of size (6-8)
- Measurement (metrics) (6-8)
- Distance between two or more objects (6-8)
- Measurement against background grid (6-8)

Quantitative Graphs and Charts Chapter 7

Basic Ideas

- Nomenclature (7-3)
- Choosing charts for communication (7-16)

What chart to use for which audiences?

- Little or no prior learning required (7-5)
- Some explanation required depending on audience familiarity in subject matter or type of chart (7-5)
- Understanding of charting theory and statistics required (7-5)

Types of simple charts

- Pie chart and 100% bar chart (percentage of total) (7-4)
- Bar chart (rank of items) (7-4)
- Line and column charts (time series) (7-4)
- Histograms and histographs (frequency distributions) (7-4)

MacroVU™ Communication Units

Chapter 8

Basic ideas

- Definitions, Principles, MacroVU™ CUs (8-8 to 8-9)
- Examples of MacroVU™ CUs (8-10 to 8-13)

Examples

- Examples of formats of MacroVU™ CUs (8-25)
- Talking figures (8-26)
- Talking diagrams (8-27)
- Documents, screens, slides (8-14 to 8-23)

Suggestions for verbal elements (8-30 to 32)

- Figures (8-26)
- Informal or formal language (8-31)

Tools and methods

- Tools for guiding the reader's eye (8-33 to 8-34)
- Methods for showing layers of description, explanation, and comment (8-35)

Color

Appendix A

Basic ideas

- Color Wheel (B-6)

Definitions

- Hues (B-6)
- Value (B-6)
- Saturation (B-6)
- Complementary colors (B-6)
- Warm colors (B-6)
- Cool colors (B-6)
- Monochromatic color scale (B-6)

Safe aesthetic choices

- Colors from the triad (B-7)
- Split complement colors (B-7)
- Variations on a single color (B-7)

Safe legibility choices for slides (B-3)

Standards and conventions

- Business conventions (B-1)
- Natural associations (B-1)
- ANSI standard for color marking physical hazards in signs (B-1)
- Sapita's recommendations for pilot lamp color code for military systems (B-1)

Cultural associations (B-2)

Standards and Conventions

Business conventions

Every domain has its own color conventions. Graphics should respect these conventions to avoid confusing viewers. For example, in Western societies, the following color conventions are widespread.

Field	Red means	Other color associations
Finance	Loss	Black = gain
Politics	Radicalism	
Temperature	Warm	Blue = cool
Mapping	Primary roads	Blue = water, green = vegetation
Traffic signs	Stop	Yellow = caution, green = go
Safety	Danger	Yellow = caution, green = safety

Based on Horton (1991, 241)

Natural associations

Color	Associated with	Meaning	
Red	Blood, fire	Danger, heat	**Action**
Yellow, orange	Sun	Brightness, daylight warmth	
Blue	Sky, water	Fresh, cool	**Passivity, quiet**
Green	Grass, trees, young leaves	Spring, life, youth	
Brown	Desert, dead vegetation	Dryness, age, death	
Paler colors	Smog, atmospheric haze	Distance	

Based on Horton (1991, 241) MacroVU research

ANSI standard for color marking physical hazards in signs

Red	Danger or stop
Orange	Dangerous parts of equipment
Yellow	Caution
Blue	Nonsafety messages
Green	Safety
Black on yellow	Radiation
Black on white	Traffic markings

ANSI Safety Color Code for Marking Physical Hazards (ANSI Z53.1). New York: American National Standards Institute, 1979.

Sapita's recommendations for pilot lamp color code for military systems

Color	Generic meaning
Red	Inoperative subsystem, error, failure
Red (flashing)	Emergency condition
Yellow	Advisory, cautionary
Green	In tolerance, ready, function activated
White	Transitory conditions
Blue	Advisory but preferably avoided

Sapita, Robert F., "Process Control Using Color Displays in Color and the Computer," ed . Durrett, H. John, Boston: Academic Press, 1987.

Cultural Associations

Color	Europe and Western Hemisphere	Japanese	Chines	Arab	Religions
Green	Growth Environment Go Balance Safe Sour Envy Jealousy Fertility Nature	Future Youth Energy		Fertility Strength	Christianity (Holy Grail; color of immortality) Judaism (Kabbalah: victory) Islam (Color of Mohammed)
Yellow	Sun Light Caution Cowardice Optimism Cheerfulness Flexibility	Grace Nobility Childish Gaiety	Earth Honor Royalty Imperial Dignity	Happiness Prosperity	Buddhism (color of Buddha's robes) Christianity (power and glory) Judaism (beauty)
Red	Stop Danger Strength Hot	Anger Danger Permissive	Danger	Joy Festive occasions	Buddhism (vicissitudes of humans) Christianity (blood of Christ; also hell and love)
Blue	Rest Calm Understanding Patience Masculinity Sweet Authority	Villainy	Sky worship	Virtue Faith Truth	Christianity (Virgin Mary) Hinduism (Gods of the Sea)
Orange	Caution Cooperation Change				Judaism (mercy)
Black	Death Somber Night Solemnity Dignified		Winter		Christianity (death) Confucianism (sacred) Hinduism (Shiva, the destroyer and creator)
White	Purity Honesty Sincerity Cleanliness Innocence	Mourning Death	Cold Moon worship		Christianity (chastity, innocence, purity) Hinduism (caste: Brahman)
Violet	Royalty Confidence Dignity	Graceful Nobility	Literary Educated		Christianity (crucifixion) Confucianism (disliked)

Based on Dreyfus (1984, 231–246), Horton (1991, 213), Porter and Milellides (1978), Travis (1991), and MacroVU research.

Research and Principles

Best Uses for Color

Color is most beneficial in the following situations:
- Unformatted displays
- High symbol density
- Operator must search for relevant information
- Symbol legibility may become degraded
- Color code is logically related to operation's task
- Information requirements and / or operator work load are high.

(From Krebs, M. J., Wolf, J. D., and Sandvig, J. H., Color Display Design Guide, Office of Naval Research Report ONR-CR213-136-2F, 1978.)

Situations in which color is particularly useful:
- In designating a specific item in a crowded display
- In demarcating a specific area of a display
- For warning signals or commands that have a limited number of possible alternatives
- For classifying or grouping data in which the number of classifications are small.

(Teichner, W. H. (1979) "Color and visual information coding," Proceedings of the Society for Information Display, 1979 (20(1) 3-9.)

Colors Identified Correctly Nearly 100% of the Time

To facilitate accurate color identification, select colors that are widely spaced in wavelength.
These are recommended:
- Violet
- Blue
- Greenish-Blue
- Bluish-Green
- Green
- Yellow-Green
- Yellow
- Orange
- Orange-Red
- Red.

(Durrett, H. J. (ed) , Color and the Computer, Boston Academic Press, 1987.)

Safe Legibility Choices for Slides

- Background: black
  (Preferred for text: white or yellow)
- Background: white
  (Preferred for text: black)
- Background: blue
  (Preferred for text: white or yellow)

Physical Facts and Limitations

Maximum Color Discrimination: several million, if seen simultaneously

Non-simultaneous Color Discrimination: between 10,000 and 20,000 colors

Design for color blindness: (Facts: 8–10 % of male population and about 1/2 of 1% of female population can not distinguish red and green. Smaller numbers can not distinguish blue. Total color-blindness is rare.) The obvious principle: don't use red or green for critical discrimination unless you use redundancy (e.g. an icon).

Major Research Findings for Color and Performance on Selected Tasks

1. Color can aid in recall
2. Color can aid performance in search-and-locate tasks
3. Color can improve comprehension
4. Color can aid in retention
5. Color can aid in decision and judgment tasks
6. Color an aid in information extraction.

Color Suggestions For Charts

1. For pie charts, use color for time and accuracy
2. For bar charts, use color for time improvement
3. For line charts, use color for accuracy
4. For tables, use color to improve time, but use black on white for accuracy
5. Use brightest color for most important point (e.g. profit line on line chart)
6. Avoid putting text on top of multiply-colored objects (e.g. on the bars of a bar chart).

Too Much Color Hinders

"When color is used selectively to direct attention to novel material, increased learning of that material will occur. Second, the use of an excessive amount of color does not serve to direct attention, and no improvement in learning is observed. In fact, excessive amounts of color have a negative influence on learning. Third, when color is presented in its richest form, such as in pictorial material, that material is recalled more accurately than if it were portrayed solely in black and white."

(Durrett, H. J. and Stimmel, D. T., "Color and the Instructional Use of the Computer," in Durrett, H. J. (ed.), Color and the Computer, Boston Academic Press, 1987.)

How Many Colors?

Between how many colors can the average person discriminate?

Maximum Color Discrimination: several million, if seen simultaneously

Non-simultaneous Color Discrimination: between 10,000 - 20,000 colors

but

Don't expect to be able to use that many colors as coding, because we can reliably remember only 11-12 colors.

Colors That Can Be Identified Correctly Nearly 100% of the Time

- Violet
- Blue
- Greenish-Blue
- Bluish-Green
- Green
- Yellow-Green
- Yellow
- Orange
- Orange-Red
- Red

(Durrett, H. J. (ed) , Color and the Computer, Boston Academic Press, 1987)

. . . unless . . .

...you study for 40 hours, in which case you can reliably remember and discriminate 50 or so colors.

but

Don't use all of these colors...use 4 (or less) to at most 7 colors on a single page or screen...

because...

that appears to be the maximum number of distinctions a person can hold in short-term memory.

. . . unless . . .

Certain situations may require more:

- a line graph with more than seven variables
- A split screen with different (unrelated) types of data plotted in the different sectors
- Realistic simulations or pictorial representations.

Smith, Wanda, (1987) "Ergonomic Vision" in Durrett, H. J. (ed) , Color and the Computer, Boston Academic Press, 1987, 109

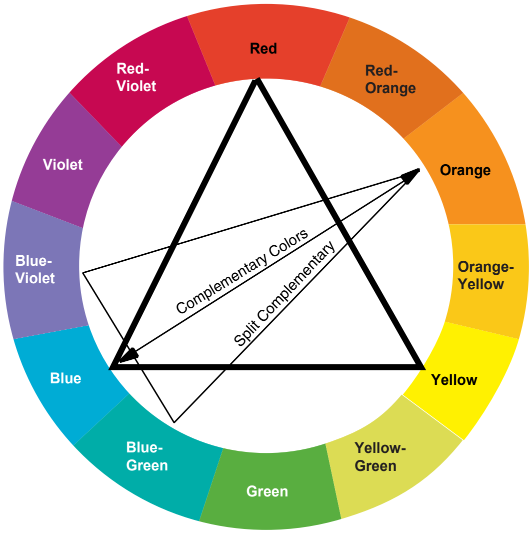
and

And don't forget to design for color blindness by redundant coding with shapes, symbols, icons, etc.

(Facts: 8 - 10 % of male population and about 1/2 of 1% of female population can not distinguish red and green. Smaller numbers can not distinguish blue. Total color-blindness is rare.) The obvious principle: don't use red or green for critical discrimination unless you use redundancy (e.g. an icon).

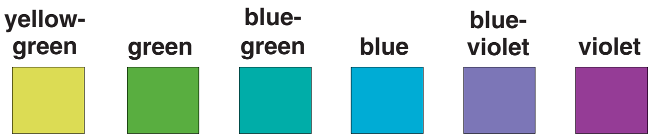
Definitions

The color wheel

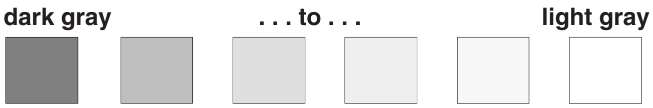


Definitions:

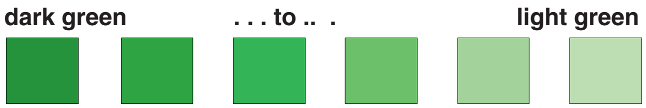
Hues. The colors as we ordinarily think of them: blue, green, yellow, etc.



Value (or lightness). The amount of black or white combined with the hue. (**Shade** is the amount of black; tint is the amount of white in a color.)

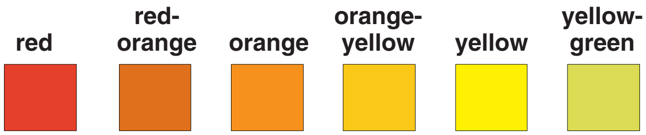


Saturation (also called chroma). How pure a hue is (dark green as opposed to light green). Different from amount of black in the color. Brighter colors are called more saturated.

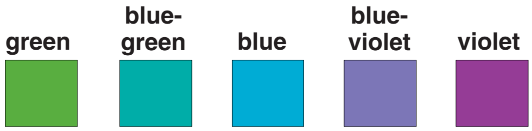


Complementary colors. Opposite on the color wheel.

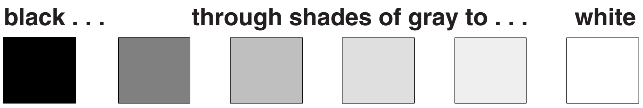
Warm colors. Yellow-orange to red. Also yellow-green. Sometimes associated with "action."



Cool colors. Blue-green to violet. Frequently associated with "quiet" or "inaction."



Monochromatic color scale. The scale of black through various shades of gray to white.



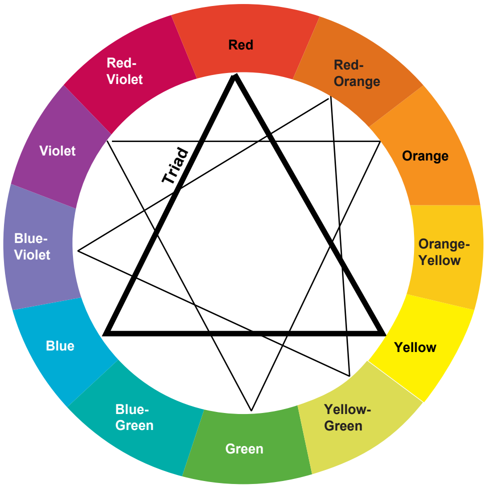
Safe Aesthetic Choices

Safe choices: colors from the triad

Triad option. Choose any three equally spaced colors on wheel.

Examples. Three triads shown:

violet, orange, green
red, blue, yellow
red-orange, blue-violet, yellow-green



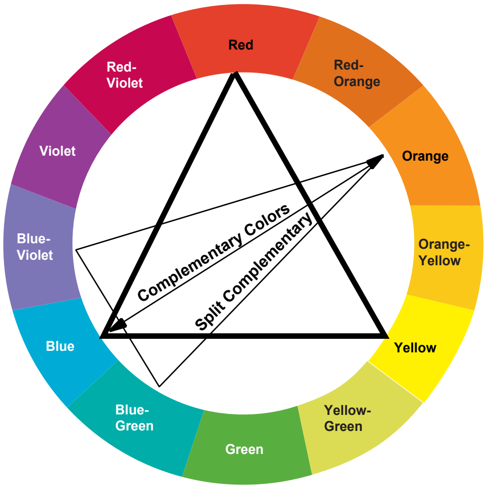
Safe choices: split complement colors

Complements. Opposites on color wheel. Complements themselves are generally not safe choices, but …

Split complements option. Split complements are the colors on either side of a complementary color. Use one color and the two colors that comprise its split complement.

Examples. Split complements shown:

blue-violet, orange, blue-green
violet, red, yellow-green



Safe choices: variations on a single color

Variations option. Choose any three colors next to one another.

Examples.

blue, blue-violet, violet
red-orange, orange, yellow